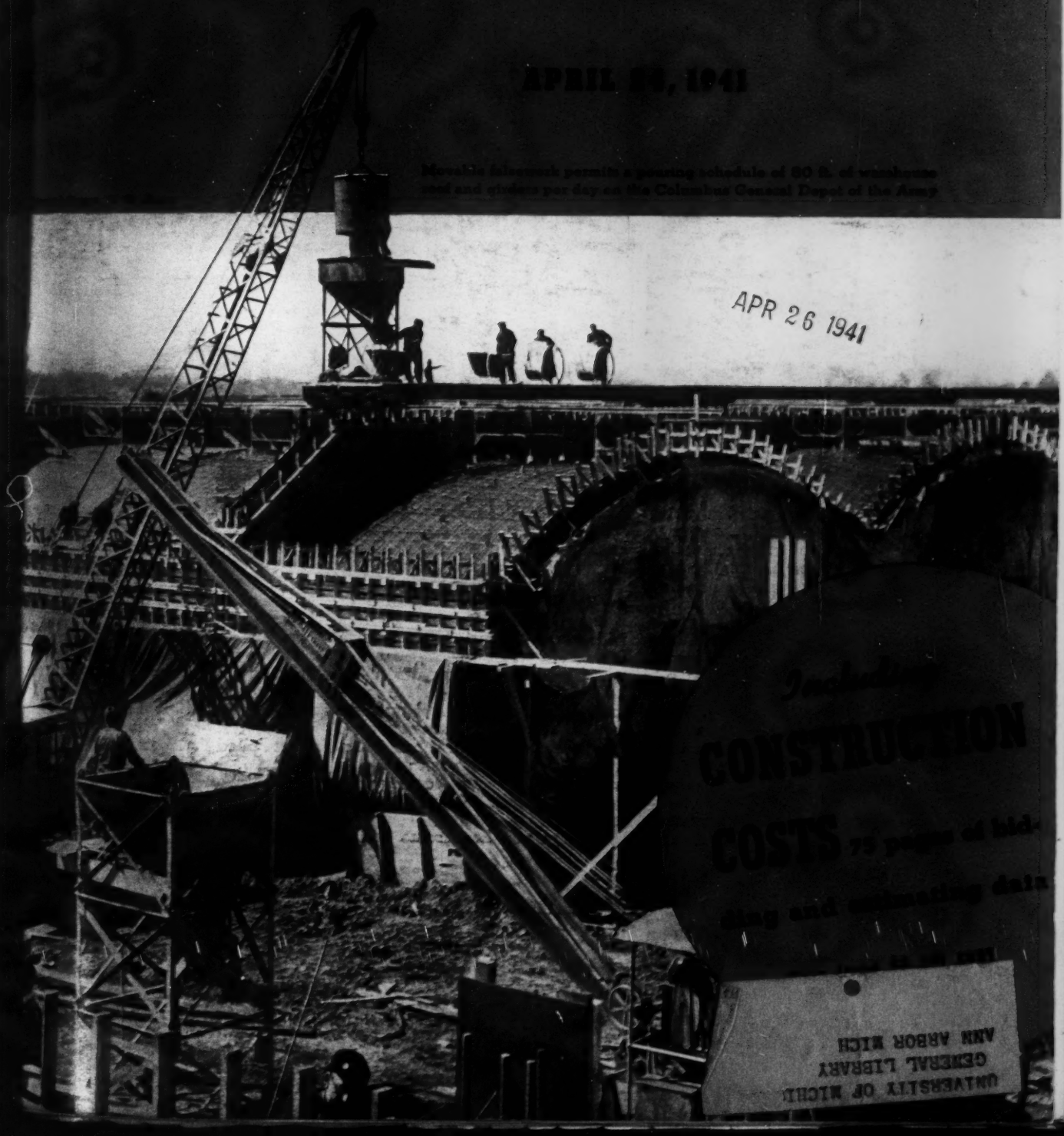
ENGINEERING NEWS-RECORD

APRIL 24, 1941

Movable falsework permits a pouring schedule of 80 ft. of warehouse roof and girders per day on the Columbus General Depot of the Army



APR 26 1941

Purchasing CONSTRUCTION COSTS 75 pages of bidding and estimating data

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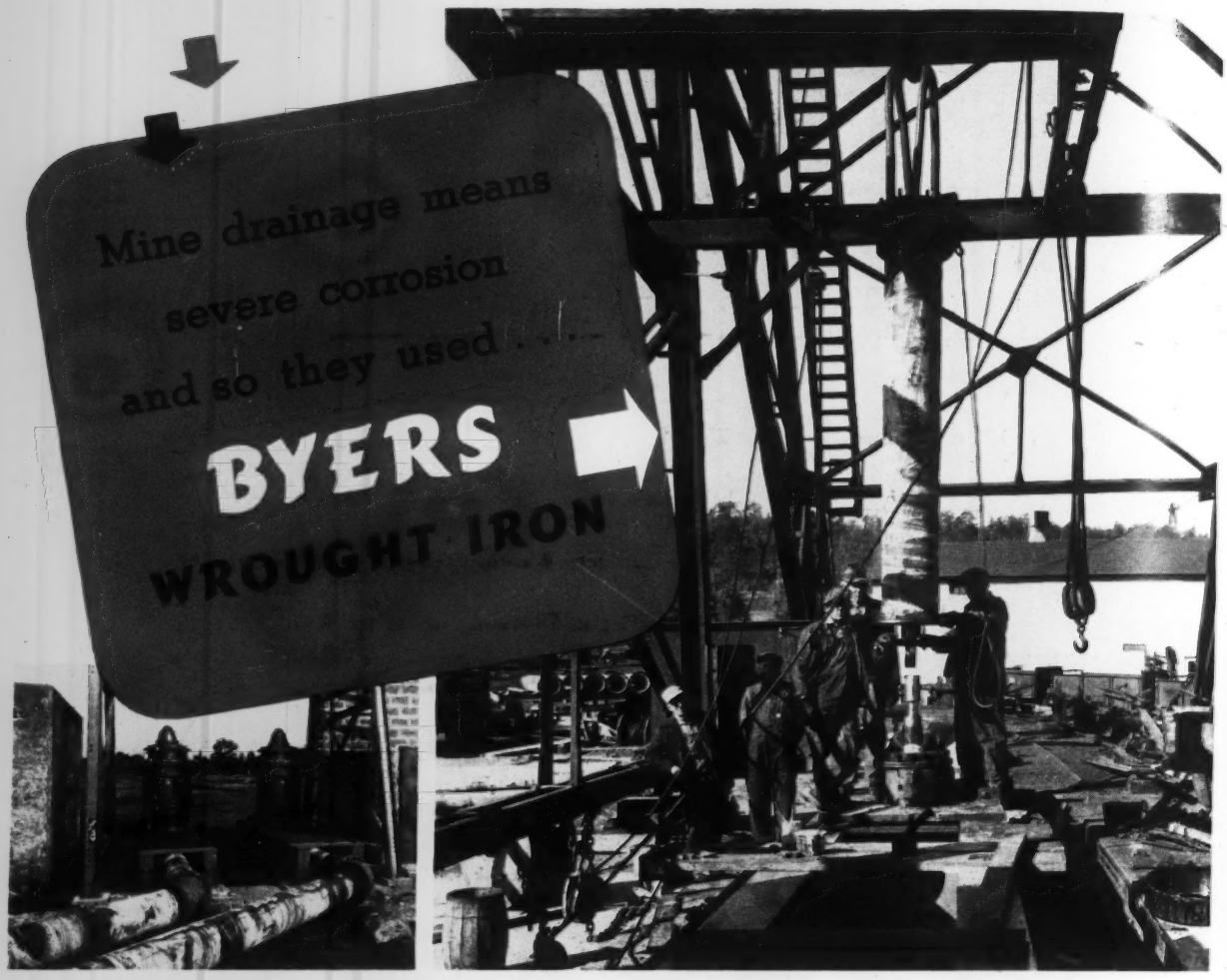

Every engineer knows the highly corrosive character of mine seepage water, and so can appreciate the problems that Philadelphia and Reading Coal and Iron Company engineers had to solve on their widespread operations. Pump equipment and piping to handle the seepage would of course be exposed to severe corrosive attack. Recently installed Turbo-type impeller pumps were located at the bottom of the intake, and driven from motors at ground level through 4⅛" shafting. The shaft was surrounded by a 5" wrought iron pipe, coated on the outside with a bitumastic material, and a 16" OD wrought iron pipe, coated both sides. The large view above shows the method of assembling shaft, the 5" pipe, and the outer pipe. The other view shows the motors and outlet pipes of a completed installation. Three units were installed in three different locations by the contractors, Peerless Pump Company. Byers Wrought Iron Pipe was used.

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WALDO G. BOWMAN, *Editor* • ALBERT E. PAXTON, *Manager*

Vol. 126 APRIL 24, 1941 No. 17

THIS WEEK

• In a 75-page "Construction Costs" section of this issue *News-Record* presents its annual compilation of data for engineers and contractors concerned with planning, bidding, appraisal and valuations. This information covers a wide variety of cost data—buildings, public housing, highways, public utilities, railroads, municipal works; material prices, bond interest and money rates, equipment rentals and a comprehensive review of unit bid prices on a wide range of construction work.

• As another development resulting from the many studies following the Tacoma bridge failure, Prof. Maney reviews model tests on a new design of suspension bridge which uses diagonal suspenders to supplement the usual vertical members.

• The role of the sanitary engineer in the U. S. Army, his duties, responsibilities and organization, are described.

• Quite different from the prairie country where most pipeline projects are located, the rocky hills and peat bogs of New England presented unusual problems for a pipeline in Massachusetts.

THINGS TO COME

• In the Ozark Mountains the Army has been building one of its major cantonments, and the problems of transportation and related difficulties makes the construction of Fort Leonard Wood outstanding among our reporting of these projects.

• Concrete piers more than 350 ft. high are the notable feature of the Pit River Bridge being built by the Bureau of Reclamation as part of the railroad relocation around Shasta Dam reservoir. An authoritative article will review the design.

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OPENED TO TRAFFIC 20 DAYS SOONER!
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Monarch Machine Tool Co., Sidney, Ohio; *Contractor:* M. C. Ferguson, Sidney, Ohio; *Architect:* Schenk & Williams, Dayton, Ohio.

12 DAYS SAVED ON FOUNDATIONS!
Rayonier, Inc., Fernandina, Fla.; *Engineer:* Central Engineering Co., Port Angeles, Washington; *Contractor:* Rust Engineering Co., Pittsburgh.

NR-H-32

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U. S. to start construction on 32 more shipways

Of the 32 ways, 18 will be built at new emergency yards. An additional 56 are scheduled under $500,000,000 lend-lease allocation for new ships

Getting ready for an emergency program of building 472 cargo ships to meet the growing shipping shortage, the U. S. Maritime Commission last week arranged for construction of 32 government-owned shipways, at existing yards, to cost about $22,500,000. Most of the ships to be turned out in these ways will go to Britain under lend-lease procedure.

The emergency ship-building program started late last year when the British government contracted with Todd Shipbuilding for sixty ships of a simplified design intended to permit quick construction and a degree of prefabrication along the lines of the Hog Island program of the last war. Early this year, this government undertook construction of 200 more of the same type. These are to be built at seven new government-owned shipyards, which are now under construction, containing a total of 51 ways.

Early this month the President allocated $500,000,000 of lease-lend funds for the construction of 212 more cargo ships—112 of them of the emergency type and the rest of them the standard high-type freighters which Maritime Commission has been building for several years. To carry out this program it will be necessary to build 56 additional shipways—some of them in the seven government yards and some in existing private yards.

Of the 32 ways announced last week, 18 are at the new emergency yards: Six at Los Angeles to be built by California Shipbuilding Corp. at an estimated cost of $4,330,000; three at Portland, Oregon Shipbuilding Corp. (contract let to H. J. Kaiser & Todd Shipbuilding Co.), $1,538,000; three at Houston, Houston Shipbuilding Corp., $1,993,000; three at Wilmington, North Carolina Shipbuilding Corp., $2,492,000; three at Baltimore, Bethlehem-Fairfield Shipyard, Inc., $2,051,000. The other 14 are in private yards: six for the Richmond Shipbuilding Corp. of Richmond, Calif., estimated to cost $4,878,000; five for Seattle-Tacoma Shipbuilding Corp., (contract let to General Construction Co., Seattle), $3,975,000; three for Pennsylvania Shipyards, Inc., Beaumont, Texas, $1,250,000.

This leaves 24 ways whose locations have still not been announced. It is understood that most of these will be assigned to the Sun Shipbuilding Co.

Senate bill would provide schools in defense areas

Federal funds for the support of schools in areas crowded by an influx of defense workers would be provided under a bill now before the Senate. The bill would authorize expenditure of $300,000,000 on construction of school building as well as equipment and current expenses. How much would go for buildings will not be known until hearings are started on the bill, probably late this month.

Regardless of this, however, the bill will remove the pressure to earmark some of the money in the pending community facilities, bill for the operation of the schools.

The later bill is now being rewritten for the second time. Reportedly, the new draft will boost the amount from $150,000,000 to $300,000,000 and definitely entrust its expenditure to John M. Carmody, administrator of the Federal Works Agency.

What Shasta's half-inch slump concrete looks like

Specifications covering the 6,000,000 cu. yd. of concrete that will go into Shasta Dam on the Sacramento River in California require "½ to ¾ in. slump." As the above views indicate, "pouring" is not the word to describe the placing of concrete conforming to such a requirement. Even when the workmen, dragging the 113-lb. vibrators, climb the pile, there is virtually no sloughing. A special cableway bucket with vertical sides and quick-opening bottom handles this dry mix with noteworthy efficiency.

The 8-yd. buckets are moved by cableways designed to provide a 300 ft. per minute lifting speed and a 1,200 ft. per minute carriage speed. Cableways radiate from a 460-ft. steel head tower. The construction plant layout was reviewed in ENR, July 4, 1940. Shasta Dam is a Bureau of Reclamation project being built by Pacific Constructors, Inc.

Power policy agency for Department of Interior

A new power division was organized this week in the Department of the Interior to unify the divergent policies on power matters of the Bureau of Reclamation, the Bonneville Administration and the Indian Service. These bodies work under quite different legislative authority; frequently use different policies, and Reclamation itself has projects such as Grand Coulee and Boulder which were established with quite different legislative bases.

The new division is not to be an engineering body but will pass on the economic and policy aspects of power projects undertaken by the three operating agencies. The administrative machinery to work out this program has not yet been set up.

First job of the new division is to draft legislation setting a pattern for the handling of power from all interior department projects. This will probably be done in connection with the formation of some kind of Columbia River Authority, which is currently being worked out jointly by the Congress and the Administration.

Heading the power division is Abe Fortas who has long been an advisor on power matters to Secretary Ickes. He was formerly on the legal staffs of SEC and PWA, and has more recently been assistant counsel to the power policy committee and general counsel of the bituminous coal division.

• • •

Right to grant utilities road right-of-way denied

North Carolina's Supreme Court has ruled that the state highway and public works commission has no authority to grant utilities the use of road right-of-ways without the consent of property owners.

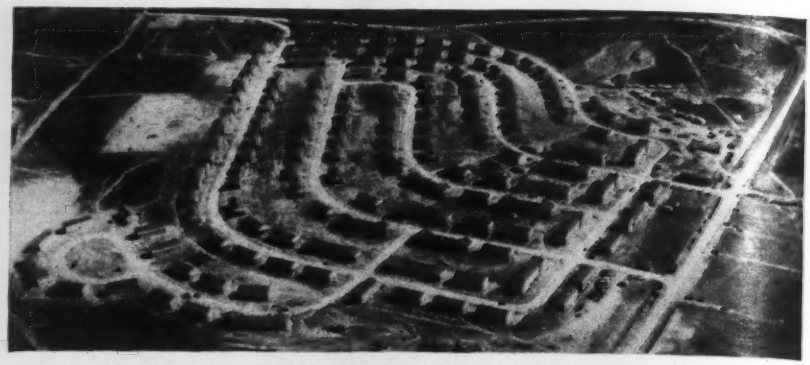
The ruling was handed down in a suit by which the plaintiff sought to restrain the Southern Bell Telephone & Telegraph Co. from erecting lines across plaintiff's property, and to recover damages for work already done on the project.

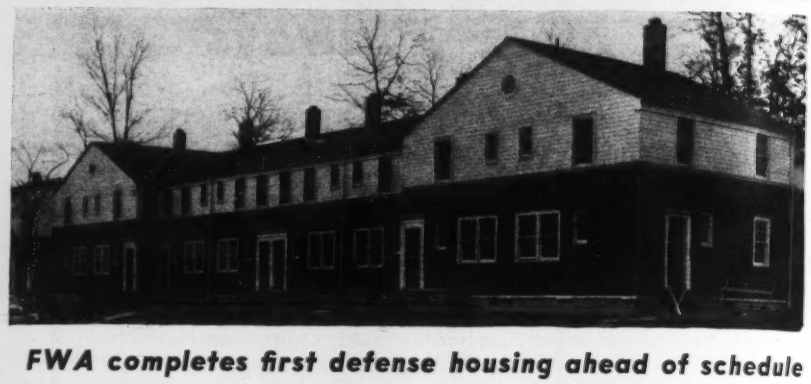
On the grounds that the highway commission has "absolute control of all land with the right-of-way of a public highway of the state, and that such right-of-way is acquired by the state not only for the ordinary mode of travel, but for any and all other modes of communicating intelligence between points connected by the highways," the Southern Bell Telephone & Telegraph Co. had sought to have the suit thrown out of court.

The court ruled that this contention would be "an attempt to appropriate private property without compensation," and ruled that the extension of telephone, telegraph, electric and pipe lines along highway rights-of-way could be done only after settlements had been reached with property owners or by condemnation proceedings. The highway commission's control of such right-of-ways does not include the power to grant such easements, the court ruled.

For nearly 20 years North Carolina highway officials have been granting such right-of-way easements to utilities under the assumption that they had the authority to do so. If the Supreme Court decision holds up, it is likely that much litigation will be instituted to recover compensation for violation of property owners' rights which have extended over the past 20 years.

The case before the Supreme Court which resulted in the ruling just handed down has not yet been settled, the court having remanded the case back to the Buncombe county general court.





FWA completes first defense housing ahead of schedule

First major defense housing undertaken by the Federal Works Agency, a 700-unit, $1,935,000 project to accommodate 2,700 persons at Fort Knox, Ky., was completed last month several days before the required completion date.

The air view at the top illustrates the orientation of houses and connecting streets on the site, which consists of 70 acres. Below in the illustration is shown a typical 8-unit multiple dwelling of frame construction, with exterior walls faced in clapboard and roofed with composition shingles.

The project consists of 4- and 8-unit multiple dwellings, with 50 percent of the 8-unit type. Each unit has its own heating plant, which consists of a warm-air coal-burning furnace with ducts leading to each room.

Fleisher Engineering & Construction Co., Buffalo, N. Y., was general contractor. Design and planning were out under the direction of Public Building Commissioner W. E. Reynolds. Supervision of construction for PBA was handled by Andrew Sandegren, project manager.

Army camp for 20,000 men completed in 90 days

Camp Barkeley, 12 miles southeast of Abilene, Tex., a 20,000-man army camp has been completed in 90 days.

Although, primarily a tent camp, there are 138 mess halls, two cafeterias, a station hospital building; 151 lavatories and 10 large warehouses, all of frame construction.

Within the camp site there are 24 miles of hard road, of which 8.2 miles are of concrete and the balance asphalt surface. Some 15,000 ft. of 18-in. mains will bring 2,000,000 gal. of water a day into the camp, if needed. Sanitary and storm sewers are complete, and 230,000 ft. of underground and overhead conduits supply the camp with electricity.

Major Richard E. Froiseth is construction quartermaster, Taylor, Byrne and Briggs, of Fort Worth, Texas, are the general contractors; Freese and Nichols are the architects.

Tacoma Bridge Report Released By PWA Board of Consultants

Slippage of center cable band found immediate cause. Corrective measures installed or planned considered ineffective.

Immediate cause of the failure of the Tacoma Narrows suspension bridge was the slipping of the center cable band on the north cable, according to a report submitted this week to John M. Carmody, Federal Works Administrator, by a special board of engineers. This slippage, it is believed, initiated a torsional vibration of the bridge structure. Design of the bridge was such that a torsional vibration, once established, tended to increase. This torsional movement caused bending stresses in the concrete floor, stressed the structural members beyond their elastic limits, and created impact loads on the suspender cables under which one of them broke; a progressive snapping of the suspender cables then followed.

The board of engineers was appointed last November by Administrator Carmody, as a result of the fact that the bridge was partially financed by PWA. The board consisted of Othmar H. Ammann, New York consulting engineer; Theodore Von Karman, of the Guggenheim Aeronautical Laboratory at California Institute of Technology; and Glenn B. Woodruff, San Francisco consulting engineer.

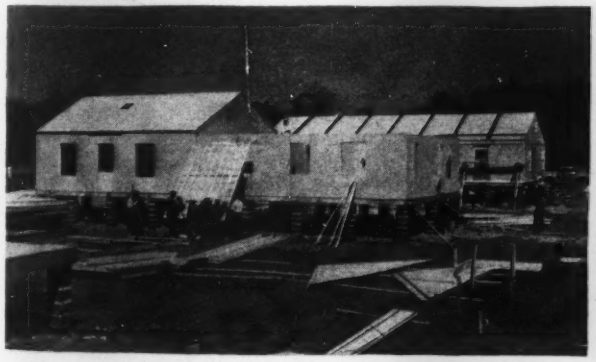
The critical slippage of the cable band was probably caused, in the board's view, by the short diagonal ties which connected the center band to the stiffening girders. This type of tie has proved effective on other bridges, it is pointed out, when the tie cables are under considerable initial tension. In the Tacoma Narrows bridge the tie cables were under only nominal tension, consequently, the vertical oscillations of the bridge, which were not in themselves dangerous, tended to slack off one tie while tightening the other, thus inducing the cable band to slip. The slippage of one cable band threw the motion of the two cables out of phase, inducing torsional motion, and at the same time eliminating the restraint to torsion which had been provided by the diagonal ties.

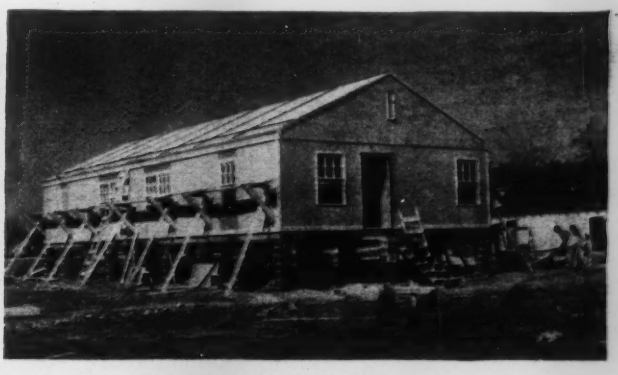
It would be incorrect, however, the report points out, to assume that a different design of the diagonal ties would have prevented the failure. The bridge might not have failed on that day, but it was so inherently inclined to torsional movement that it would inevitably have failed at a wind velocity well below the 100 mph. for which it was designed.

Above a certain wind velocity any suspension bridge tends, if torsion starts, to fall into an increasing torsional movement the board found. The wider the bridge the higher is the critical wind velocity. Moreover, if the bridge is rigid, the structural damping action will counter-balance the aerodynamic negative damping action. The Tacoma bridge combined an unusually narrow roadway with an unusually flexible construction and was thus aerodynamically unstable as regards torsional vibration at a comparatively low wind velocity. It was stable as to vertical oscillation.

None of the measures adopted or planned to resist the oscillation of the bridge had or would have had, in the opinion of the board, any great effectiveness. The diagonal ties at center, as pointed out, contributed to the failure. The tie-down cables under the side spans were effective in reducing motion of the side spans, but motion of the main span was almost entirely independent of that of the side spans. Diagonal stay ropes from the top of the towers would have increased the rigidity of the structure, but probably not enough to compensate for its extreme flexibility.

The board concluded that the bridge was well-designed and built to resist all the static forces, including wind, usually considered, but it was not realized that aerodynamic forces, which have wrecked lighter spans in the past, could affect a structure of such size. The PWA and the RFC were entirely justified in assuming that the experience and reputation of the consultants on the bridge removed any doubts as to its adequacy.





Uncle Sam gets his first prefabricated demountable house

There was no ceremony at Indian Head, Md. on Tuesday, April 8, but the occasion might have been marked in some way. On that day Uncle Sam could have witnessed the completion of his first prefabricated demountable house, a product of Allied Housing Associates of Langhorne, Pa. An ENGINEERING NEWS-RECORD editor, the only visitor on the job at the time, recorded the memorable event as pictured above.

Indian Head, adjacent to a Naval powder-loading station, is the site of the prefabrication demonstration "laboratory" recently established by the Public Buildings Administration. Some 10 prefabricators already have been awarded contracts, and a total of 650 houses of different type will be erected in this combination demonstration—defense housing project (ENR, Mar. 6, p. 371 and Apr. 17, p. 579, 1941).

The Allied Housing Associates' houses are assembled from prefabricated panels shipped to the site. The panels are made up from Homosote board (pulped newspaper composition which is pressed and made fireproof) and 2x3 in. wood studding. Painted with a special compound after erection, the panels are said to be waterproof and entirely resistant to weathering. Floor and panel sections are held together with bolts so that these houses can be easily demounted.

Funds for the units at Indian Head, which were made available under the Lanham Defense Housing Act, were allocated to the Public Buildings Administration by the Federal Works Administrator. Design of the houses, site plans, and negotiations with the contractor have been under the direction of the Commissioner of Public Buildings.

Fort Peck tunnel control gates completed

Installation of the main control gates and operating machinery of the four tunnels at Fort Peck dam in Montana has been completed by Fegles Construction Company, Limited, of Minneapolis. The contract, awarded in December, 1937, involved the installation of heavy castings and steel sections requiring unusual precision in assembly on the job. The gates are installed in three of the four 50 ft. diameter control shafts. They are of the steel cylinder type, weighing 100 tons each. Principal quantities involved include 2,514,000 lb. of steel liners and castings, 10,900 lb. steel pipe, 43,000 lb. bronze, 2,353,000 lb. of steel reinforcing, and 18,866 cu. yd. of concrete all in addition to the cylinder gates.

In shafts 3 and 4, gates were installed at two elevations, one at 55 ft. above the floor of the tunnel and the other 135 ft. above the tunnel floor. Only the lower gate was installed in shaft 2. The shaft for tunnel No. 1 does not contain gates, as it is to be used as an auxiliary surge tank for the powerhouse, now under construction. Tunnels 2, 3 and 4 will be utilized for outlet and reservoir control works.

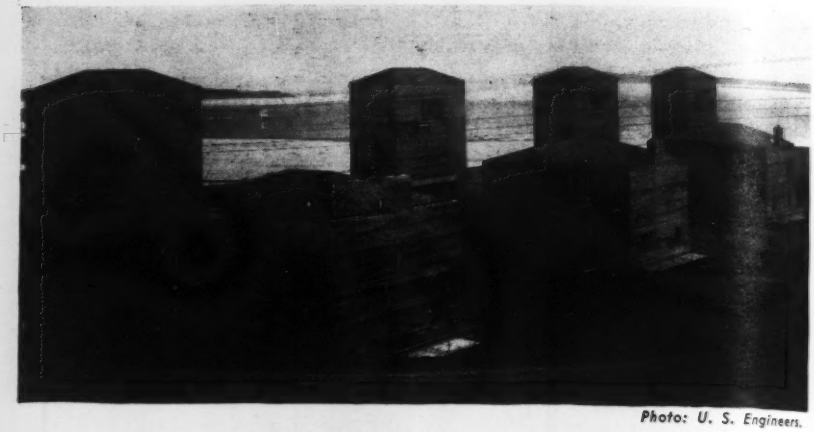


Photo: U. S. Engineers.

Tunnel control houses at Fort Peck Dam

This view shows the completed tunnel control buildings located on the east abutment directly over the tunnels of Fort Peck Dam. The higher buildings house the operating machinery for the emergency gates and the buildings in the foreground house the main control-gate operating machinery. In the background can be seen the reservoir.

• • •

North Carolina to up highway salaries

A committee of highway engineers has just been appointed to draft new salary schedules, which will result in 8,500 employees of the North Carolina State Highway and Public Works Commission receiving pay increases aggregating $500,000.

The committee was named by W. Vance Baise, chief highway engineer, and has been approved by the highway and public works commission. The 1941 North Carolina legislature requested that the commission make such a survey "with the view of eliminating inequalities of persons of substantially equal qualifications rendering substantially similar service, and to establish a minimum basis of pay at least equal to the prevailing wage of private employment."

It is expected that of the $500,000 to be distributed in pay increases, $400,000 will go to employees who now receive less than $125 a month.

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Maryland to safeguard its water supplies

Maryland's state department of health engineer, George L. Hall, has recommended to municipal and waterworks officials throughout the state certain measures which should be taken immediately to prevent any disruption of water service, which might impede the work of those industries now engaged on national defense orders.

As a preliminary step, officials are urged to make an immediate inventory of all materials, supplies and equipment on hand to determine if stocks are adequate to maintain service in case of an emergency affecting normal operation of their water treatment plant and distribution system. It is urged that stock shortages be replaced as quickly as possible.

A suggestion has been made to the smaller communities that they pool their resources and maintain an adequate stock centrally located and accessible to all concerned, thus avoiding duplication of purchases and unnecessary expenditures.

• • •

New contract will be let for Detroit housing project

Detroit's Housing Commission has announced it will call for bids soon for completion of the Herman Gardens housing project. A recent court ruling voided the original contract held jointly by Lipman Const. Co. and A. Smith & Co., both of Chicago. The court decision followed revelation of alleged fraud on the part of the contractors in bribing Detroit councilmen to award the contract on the basis of a concrete construction alternate. (*ENR*, April 10, 1941—vol. p. 518.)

Meanwhile, the War Department has "terminated" a contract recently awarded A. Smith & Co. for construction of temporary hospital buildings at Fort Sheridan, Ill.

Expansion planned for Grand River project

Expansion of the Grand River hydroelectric project in Oklahoma into a $25,113,636 development, and immediate construction of two giant transmission lines to the Tulsa, Okla. area, is being planned by the Grand River Dam Authority, according to reports given out when the GRDA recently applied for an additional $2,363,636 from the PWA. The additional funds have been authorized.

Federal funds in the amount of $22,750,000 have been allocated. With the additional moneys, GRDA plans to expand its program as follows: (1) build two 110,000-volt lines to Tulsa, and a 69,000-volt tie line between a substation near a bomber assembly plant now being erected and another 69,000-volt line now under construction to Collinsville; (2) construct a 69,000-volt line to the tri-state lead and zinc mining field via Miami, and (3) install a fifth turbo-generator at the power house, increasing GRDA's salable capacity to 53,000 kw.

• • •

Speed limit set at 70 mph for Pennsylvania Turnpike

Pennsylvania's Governor Arthur H. James has signed a legislative bill establishing a 70 mph speed limit for the Pennsylvania Turnpike. Officials of the Pennsylvania Turnpike Commission state that the law will be strictly enforced.

The commission has authority to reduce this speed limit on certain portions of the superhighway. Ten persons have died in traffic accidents on the road since it was opened last October.

With 10,000 employed, WPA rushes construction on defense access roads

Working on a 24 hr. a day schedule, seven days a week, 86 projects are being built at a cost of $15,000,000

With 10,000 WPA workers employed on 86 projects, defense access road construction is being rushed to provide urgently needed facilities leading to Army and Navy centers. The aggregate cost of such roads now under construction is $15,000,000.

The acute need for adequate access roads is indicated by the fact that in many instances the WPA has authorized extra shifts which permit construction to go forward 24 hours a day, seven days a week. The urgency of the situation now is partially due to the failure of Congress to provide adequate appropriations for such roads in the beginning of the defense construction program.

In addition to the 86 road projects already approved for the Army and Navy, the War Department has requested WPA to construct additional access roads to 55 industrial plants which are working on defense contracts.

Seven of the industrial plants for which road projects have been requested are in Indiana, five each are located in Michigan and Ohio, and four in Illinois; the remaining 34 are distributed among other states from Massachusetts to California.

In many cases camps quartering thousands of men are reached only by narrow dirt or macadam roads never meant to bear the tremendous burden of traffic which they now have. Heavy use of these roads during the last few months has made them hazardous or destroyed the surfacing, with the result that traffic leading to and from the camps is greatly retarded.

The type of work now being performed by WPA ranges from temporary gravelled roads, necessary to expedite camp construction, to four-lane concrete highways and heavy bridges to fill more permanent needs. Examples of the heavier type of construction are the four-lane concrete highway from Jacksonville, Fla., which bypasses heavy traffic zones to cross the Ortega River, providing access to both the naval air station and Camp Blanding, and the four-lane concrete highway under construction between Fayetteville, N. C. and Fort Bragg.

Typical of access roads being constructed by WPA to facilitate transportation problems for defense industry plants is one near Columbus, Ohio, which will connect Port Columbus, the Curtiss-Wright airplane factory and the U. S. General Depot. The new highway is of dual type construction with two 24-ft. hard surface traffic lanes separated by a 16-ft. parkway. The project will cost $294,000, of which $236,000 will be supplied by WPA and is scheduled for completion July 1.

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Supply of civil engineers seen ample for defense

In presenting an analysis of the civil engineering employment situation at the regular monthly meeting of the Metropolitan Section of the American Society of Civil Engineers on April 16, Walter E. Jessup, Am. Soc. C.E. field secretary, voiced the opinion that any presently contemplated construction program can be successfully handled by the talent available. His conclusion was largely based on the fact that total construction in 1941 will fall short of the 1927 volume, which was handled without difficulty.

Mr. Jessup, however, did not minimize the difficulties of marshalling the available manpower at the particular spots where it is needed. He also called attention to the fact that civil engineering students composed 22 per cent of the total engineering enrollment in 1926, compared to only 11 per cent this year; there are more engineering students today than 15 years ago, but the civil engineering declines is nevertheless substantial. The profession is also losing students who take commissions in the armed services, or who are called for selective service training. Of the total of 10,000 civil engineering graduates, about 2,000 will probably go into the Army and Navy. Aircraft and shipyard work are also taking structural engineers away from construction.

Despite fewer civil engineers being available now than in 1927, however, it is Mr. Jessup's opinion that they are available in ample number, particularly since the peak of demand from the present program will soon be past.

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Iowa passes gas tax legislation

The Iowa legislature has approved a constitutional amendment which would prohibit use of gasoline tax and motor vehicle license funds for anything except highway work. Thus, for the second time, as required by the state constitution, the general assembly has approved the measure and it is now scheduled for a popular vote in 1942. While proponents of the amendment said there have been no serious forays on the funds, they advocated the amendment to prevent tapping of the $30,000,000 annual income which is derived from gas and vehicle license taxes.

Soldiering at the Moles Frolic

The Moles Annual Frolic, held in New York on April 16, featured camp fare and martial entertainment. Forgetting construction grief for bean soup, and corned beef, more than 600 construction men of the metropolitan area took a "shift" off for a congenial get-together.

Shown above, left to right are A. H. (Gus) Ayres, project manager for Utah Construction Co. on the Delaware Aqueduct, and Nantahala Dam in North Carolina; H. W. Hudson, engineer of construction for Madigan-Hyland, consulting engineers of New York; and Samuel W. Marshall, formerly chief engineer on the Pennsylvania Turnpike and now chief engineer for Caribbean Architects & Engineers.

A. M. Stagg of Newark, N. J., is president of the Moles, an organization of men engaged in tunnel, subway and other heavy construction. Al Warwick, contractor of Long Island City, was in charge of the entertainment.

Movies of Tacoma Bridge failure now available

A very comprehensive moving picture of the oscillatory movements of the Tacoma Narrows Bridge (1) in the month before the collapse, (2) as studied on models and (3) as they actually appeared during the hour preceding failure, and in the collapse on Nov. 7, can now be purchased in two reels (totaling 800 ft.) of 16 mm. film. The first reel shows early studies and the second is devoted to the collapse, including very striking close-ups of the torsional motion made just prior to the break-up. The film has been assembled and edited by Prof. F. B. Farquharson, University of Washington, and orders are being filled by the Camera Shop, 1921 Pacific Ave., Tacoma, Wash. Price of the two reels has been announced at $50.

• • •

Illinois Tech plans $12,000,000 expansion

A $12,000,000 development program for Illinois Institute of Technology, Chicago, to include immediate construction of metallurgical, humanities and mechanical engineering buildings, and a library, was announced April 14 by the school's board of trustees.

Twenty acres on the South Side already have been acquired, and the immediate building program calls for an investment of $1,500,000. The long term program, planned for "the next several years," calls for the construction and equipment of a civil engineering and materials laboratory building, a chemical engineering and chemistry building, an electrical engineering and physics building, a student union, a field house and a power plant.

Urge return of empty wire and cable reels

Wire and cable manufacturers are faced with an acute shortage of shipping reels and spools, primarily through the failure of busy users to return the empties, according to the General Cable Corp., New York. The manufacturers are buying and making reels as fast as possible, but are not able to assemble an adequate supply rapidly enough. Contractors who have empty reels and spools are urged to return them to the manufacturers as quickly as possible, in order to expedite wire and cable shipments to national defense projects, and to conserve for national defense work the time, materials and labor required to build new reels and spools.

JOBS OF THE WEEK

DEFENSE HOUSING, Erie, Pa.

W. F. Trimble & Sons Co., Pittsburgh, Pa., has been awarded contract to construct 500 defense housing units for Housing Authority of Erie. Cost will be $1,731,500. W. T. Monahan, Erie is architect. Beman & Candee, Buffalo are engineers.

SHELL MANUFACTURNG PLANT, Cleveland, O.

Stone & Webster, Inc., Boston, Mass. will build brass shell manufacturing plant including 1 story, 470x1,180 ft. main factory; power plant, water filtration plant, storage building, loading dock, railroad siding, office for Chase Brass & Copper Co., Inc., Waterbury, Conn. Estimated total cost $16,000,000. W. L. Smith is plant engineer.

AIRPLANE PARTS PLANT, Akron, O.

Clemmer Construction Co., Akron, O., has been awarded a contract for the construction of 400x1,000 ft. airplane parts plant, by Goodyear Aircraft Corp., Akron. Total estimated cost $3,700,000.

DRYDOCKS, Etc., Charleston, S. C.

MacDougald Construction Co., Charleston, S. C. awarded contract constructing drydocks, shipbuilding facilities at Charleston Navy Yard, by Yards & Docks, Navy Department, Washington, D. C., $2,465,000.

PILOT TRAINING SCHOOL, Victoria, Tex.

American-Friedman-Bitulithic Associates, Houston, Tex. will erect advanced pilot training school for air corps. Estimated cost $1,525,000. U. S. Engineers, San Antonio, took bids. Work includes temporary barracks, storage, hangars, flying field, etc., on 640 acres. The firms making up American-Friedman-Bithulithic are American Construction Co., Houston; Texas Bithulithic Co., Dallas, and Harry B. Friedman, Fort Worth.

DREDGING AT PANAMA CANAL

Panama Constructors, Inc., White Plains, N. Y. were lowest bidders for removal 30,000,000 cu. yd. material from new Miraflores Locks, Pedro Miguel Locks and north approach channel to Pedro Miguel Lock, Third Lock Project. The lowest bid was $22,436,086, when opened by General Purchasing agent, Panama Canal, Washington, D. C.

PLANT, Hamilton, O.

Navy Department, awarded contract for acquisition, construction and installing additional plant facilities, including extending existing buildings, to General Machinery Corp. at $1,499,000, and plant will be used by Hooven, Owens, Bentschler Co., a subsidiary, for the production of naval propelling machinery.

HANGARS, Washington, D. C.

John McShain, Inc., Philadelphia, Pa. will build five hangars at Washington National airport, Gravelly Point, for Public Buildings Administration, Washington, D. C. Cost will be $2,076,700.

FLEETING OPERATING FACILITIES, Guam and Samoa

Hawaiian Associates, New York, N. Y. have been awarded fleet operating facilities, additional power and recreational facilities, at Naval Station Guam. Estimated cost $4,700,000; also seaplane operating facilities, housing and defense projects at Naval Air station, Tutuila, Samoa, Estimated cost $8,100,000. The Hawaiian Associates include Hawaiian Dredging Co., Lta., Honolulu, Raymond Concrete Pile Co., New York, N. Y., Turner Construction Co., New York, Morrison-Knudsen Co., Los Angeles, Calif., J. H. Pomeroy & Co., San Francisco.

FOUNDRY and STRUCTURAL SHOP, Brooklyn, N. Y.

Thompson-Starrett Co., Inc., New York, N. Y. has been awarded contract for constructing foundry and extension to existing structural shop by Bureau Yards & Docks, Navy Department, Washington, D. C., Estimated cost $1,650,000.

STEAM GENERATING PLANT, Wilmington, Calif.

Department of Water & Power, Los Angeles, Calif. will construct by own forces and separate contracts first unit of new steam generating plant. Cost of construction will be $2,065,000, with equipment at $2,150,000. H. E. Gardett, Los Angeles, is engineer.

NOTE—Additional bidding and contract news on over 800 projects large and small appear in the Construction News section beginning on page 245.

OBITUARY

CHARLES BUSS RICHARDS, president emeritus of Lehigh University, died April 17 at his home in Minneapolis, Minn. Mr. Richards resigned the presidency of Lehigh University in May, 1935, because of ill health, after having served 16 years. He became president at Lehigh after 30 years of teaching at Colorado Agricultural College, and dean of the engineering school of the University of Nebraska and the University of Illinois. He was a graduate of Purdue and Cornell universities. Mr. Richards died in his 70th year.

JOHN T. HUGHES, 68, chief steel inspector of the R. W. Hunt Co., engineers, died April 11 at Pittsburgh, Pa.

JOHN PERETT MONTURN, formerly an engineer with the Arkansas State Highway Department, died April 13 at Camden, Ark.

CHARLES B. OWEN, widely known highway contractor, died April 14 near Hanna, Wyo. in an airplane crash. He was vice president of the Colorado Association of Highway Contractors.

CYRUS P. M. TINSTMAN, 63, died April 11 at Pittsburgh, Pa. Mr. Tinstman was a graduate of Pennsylvania Military Academy in engineering.

MANUEL MURIEL CABRERA, prominent Mexican civil engineer, 54, died recently at his home in Mexico City. He was a graduate of Massachusetts Institute of Technology.

ROBERT GRIMSHAW, 91, retired international consulting industrial engineer, died April 9 at Englewood, N. J.

THOMAS L. BURRELL, 75, consulting engineer for the Standard Oil Co., died April 18 at Cleveland, Ohio.

MARTIN P. COSTELLO, 72, engineer, died April 15 at Akron, Ohio. Mr. Costello was employed by the Pennsylvania Railroad.

GEORGE STEPHEN JENNINGS, former engineer for the U. S. Bureau of Public Roads, died April 12 at Salt Lake City, Utah.

ROBERT FARNHAM, 63, assistant chief engineer of the Pennsylvania Railroad, Eastern division, died April 8, at Philadelphia, Pa. A civil engineer, he was a graduate of Lehigh University. Mr. Farnham directed the building of a large portion of the Union Station at Washington, D. C., the 30th Street Station at Philadelphia, and electrification work throughout the eastern area.

WALTER SCOTT STANDIFER, 83, civil engineer, died recently at his home in Atlanta, Ga. Mr. Standifer was assistant to William C. Gorgas during construction of the Panama Canal.

FRANK B. VAN SICKLE, 54, engineer, died April 8 at Cleveland, Ohio. For 20 years he was connected with the General Electric Co.

GAVIN WILLIAM HAMILTON, 65, railway, tunnel and highway contractor, died April 17 at Denver, Colo. He was president of the contracting firm of Hamilton & Gleason Co., Denver.

GEORGE J. LACOURSE, leading Connecticut contractor for many years, died April 15 at Bristol, Conn.

JOHN W. RADFORD, 75, construction contractor, died April 8 at Los Angeles, Calif.

STEPHEN NOVICK, 75, contractor, died April 16 at St. Petersburg, Fla.

JOHN M. ROBERTS, 67, Lincoln, Neb. civil engineer and contractor, died recently at Lincoln.

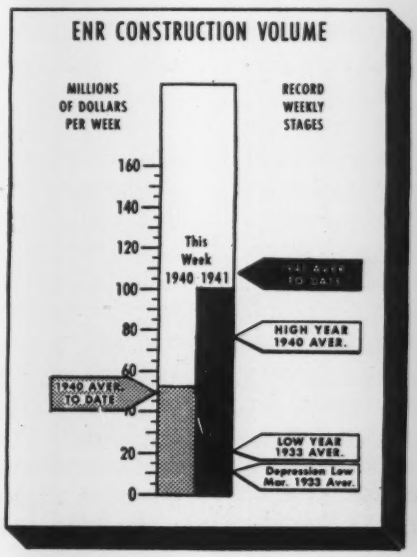
CONTRACTS AND CAPITAL

ENGINEERING CONSTRUCTION awards for the week, $107,090,000, top the 1941 low of a week ago by 62 percent, and are 107 percent above the total for the corresponding 1940 week.

Private awards reached the second highest peak of the year, and exceed last week by 146 percent and the 1940 week by 123 percent. Public construction is 32 percent higher than a week ago, and 98 percent above a year ago.

This week's total brings 1941 construction to $1,842,811,000, an increase of 116 percent over the volume for the opening 17-week period last year. Private construction, $511,879,00, is 71 percent above a year ago, and public, $1,330,932,000, is up 140 percent due to the 885 percent gain in federal work.

In the classified construction groups, gains over last year are in industrial, public and commercial buildings, and unclassified construction. All of these classes of work, and, in addition, sewerage construction report increases over last week.



New capital for construction purposes for the week totals $762,346,000. This compares with $17,667,000 for the corresponding week last year. The current week's financing is made up of $751,952,000 in federal appropriations from the Fifth Supplemental National Defense Appropriation Bill, $5,855,000 in state and municipal bond sales, $4,469,000 in corporate security issues, and $70,000 in RFC loans for public improvements.

New construction financing for 1941 to date, $3,047,784,000, is 735 percent greater than the volume reported for the first 17 weeks of 1940.

CONTRACTS

(Thousands of dollars)

	Week Ending Apr. 25 1940	Apr. 17 1941	Apr. 24 1941
Federal	$3,331	$26,427	$37,820
State & Municipal	29,455	22,696	27,033
Total public	$32,786	$49,123	$64,853
Total private	18,967	17,185	42,237
TOTALS	$51,753	$66,308	$107,090
Cumulative 1941 (17 weeks)			$1,842,811
1940 (17 weeks)			$854,557

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1940 17 weeks	1941 17 weeks
NON-FEDERAL	$365,300	$328,947
Corp. Securities	66,211	105,712
State & Mun.	225,026	183,544
U.S.H.A. loans	73,551	13,521
R.F.C. loans	512	26,170
FEDERAL		$2,718,837
TOTAL CAPITAL	$365,300	$3,047,784

FHA MORTGAGES

	Week Ending Apr. 20 1940	Apr. 12 1941	Apr. 19 1941
Selected for appraisal	$28,202	$33,702	$34,820*
Cumulative 1941 (16 weeks)			$416,817*
1940 (16 weeks)			$355,749

* Subject to revision.

ENR INDEX NUMBERS

Index Base=100		1913	1926
Construction Cost	Apr. '41	252.40	121.33
Building Cost	Apr. '41	208.60	112.76
Volume	Mar. '41	386	169

EDITORIALS

VOLUME 126 NUMBER 17

April 24, 1941

Construction Costs

NOT FOR TWO DECADES have construction costs been so high nor so volatile as they are today. As such they constitute a real danger to everyone forced to subject his operations to their effects. Bred and fed by influences outside the control of the construction industry, costs nevertheless need not be a wholly unrestrained factor that makes every job a complete gamble. By knowledge of construction cost history and by attention to construction cost trends, the estimator, the engineer and the contractor can do much to chart their course safely even though they can't make costs stand still. Nearly 75 pages of this issue are devoted to the presentation of data that have for years made this task easier. In a year of uncertainty they assume added importance.

Big Wind Tunnel Wanted

SINCE THE COLLAPSE of the Tacoma Narrows Bridge, engineers from coast to coast have busied themselves in drafting room and laboratory with ideas for making suspension structures more resistant to wind. A number of intriguing possibilities have been suggested, ranging from streamlined to open mesh decks, from special storm cable layouts to a trussed hanger system, the latter described in this issue. What is lacking for all of these proposals is a convincing demonstration that they can deliver the rigidity that theoretical considerations seem to assure. True, some of them have lived up to promises in small models tested in makeshift wind streams, but such testing is more suggestive than convincing. What is needed is a large-scale model test, such as could be carried out in a large wind tunnel where all test conditions would be under scientific control and where variables could be reduced to bare essentials. Whether the wind tunnel at Langley Field, the only one that seems to be large enough for the purpose, could be released for such a test while aeronautic investigation is so compelling, is problematical. However, since time would be required to develop a test program and build the necessary models, it is possible that a tunnel would be available when needed. The subject of large-scale wind tunnel tests is worth careful consideration by every governmental body and private organization interested in improving transportation efficiency.

A Planned Depression

IT IS CHARACTERISTIC of economic crises that they are unexpected and unplanned for. Likewise, characteristically, measures to meet their impact are usually improvisations assumed to have the power of dissipating the difficulties in an incredibly short time. Thus, all through the Thirties, the government undertook one program after another of emergency public works—each time without advance preparation and each time organized on the basis that this one would do the trick, would end the depression and make any further programs unnecessary. None of them was more than nominally successful and, as a result, it was never possible to obtain either the maximum employment or the maximum of useful value for the money expended.

Today the country is in the unique position of knowing that a crisis is coming. Our whole economy is being warped toward preparation for war. Everyone hopes that sometime we can shift it back; and everyone knows that that shift will impose a terrific shock. Whether that shock can be absorbed or whether it will create a new depression worse than that of the last decade, depends, in part at least, on the quality of the planning that is done now. Actions that will have to be taken extend far beyond public works expansion (and this fact must not be allowed to be forgotten), but public works, unquestionably, is an important element.

We have the opportunity to prepare in advance a public works program that can be put into motion with the maximum speed and effectiveness when the need arises. The President has indicated that he is awake to this opportunity, and in a report summarized elsewhere in this issue the National Resources Planning Board suggests lines of action that might be taken now in preparation for the emergency to come. Major elements are the provision of funds to various governmental agencies for advance design of specific projects, the formulation and passage of legislation setting up grant-and-loan or similar machinery, and the selection of projects. These proposals are sound. But they are broadly drafted, and the best thinking of engineers, economists and administrators will be required to implement their usefulness.

An important object of this thinking not men-

tioned by the NRPB report should be to determine which offers the greatest net gain to the national economy—transforming the construction industry into a relief organization, manned by unemployed clerks and tradesmen as under the WPA, or keeping the experienced organizations and manpower of construction working at "all-out" efficiency, as under PWA or some similar setup. If we are going to plan for a depression, we want to plan to end it and not merely to palliate it.

Uncle Sam Tries Prefabrication

WITH DEFENSE HOUSING NEEDS piling up, Uncle Sam at last has gotten seriously interested in prefabrication. At Indian Head, Md., site of the long-discussed "pre-fab lab", work has been started by some of the ten prefabricators who will build 650 houses of different types and materials to demonstrate for the Public Buildings Administration what can be done. At Camden, N. J., a special division of the FWA is about half finished with a village of 184 frame houses, the major portion of which are "section-built" in a nearby fabricating plant. And in Sheffield, Ala., the FWA has given a contract to TVA for the construction of 150 "unit-built" houses, a recent creation of the authority's architectural staff.

Proponents of prefabrication, pointing to the economy and speed obtainable with this type of construction, have criticized the government's failure to seize upon prefabrication in this housing emergency. Admittedly, there may be some cause for criticism, but the problem is not a simple one. First, the prefabricators already in the business were not ready to undertake immediately the volume of work projected since they had never had enough business to support mass production set-ups. Then, their designs did not include the demountability feature that the government thought necessary. The question of labor's attitude was also important, since the craft unions, particularly, have opposed the introduction of prefabrication.

Other factors which have caused hesitation are cost estimates and building code restrictions. Ignoring speed advantages, prefabricated houses at present cost almost as much as conventionally built structures, although this situation undoubtedly would be changed under mass production schedules. And building codes, in many places outmoded as a Model T Ford, challenge even the suggestion of prefabrication and the materials proposed for its use.

Despite these obstacles, however, prefabrication has many merits pointing to immediate use and for future housing requirements. Uncle Sam will do himself a good turn by giving the idea a sound trial.

The Great Road Mystery

FAILURE OF THE ADMINISTRATION to ask Congress for money to build adequate roads into the many military camps and new defense industries scattered across the country becomes a deeper mystery as each week passes. On Feb. 1, John M. Carmody, Federal Works Administration, reported to the President that the Public Roads Administration had found that $287,000,000 was needed for defense roads of various types and that of this, $150,000,000 was needed for immediate construction of camp access roads. Since then the President has asked Congress for billions of dollars for other defense needs, some of them still remote, but has not asked for one cent to meet the very present need for better roads into camps and new defense industries that now are seriously handicapped by lack of them.

A few state highway departments have been able to divert money from other purposes to access roads, but most of what is now being done is being financed by the WPA. From this it may be concluded that the President is purposely not asking for money to turn over to the states for this work in order to give the WPA something to do in the defense program. But that does not line up with the professed social objectives of the Administration. Why save a few millions of dollars by making American citizens do this work at relief rates instead of paying them what they would get under normal contract construction when we are spending billions for aiding the British? To say that the WPA is doing a good job is not the answer. If it were the answer, we should be building ships and airplanes at the same low level of pay, and at the same sacrifice of speed and efficiency.

Last week the President named an advisory committee to plan for post-war road work. A more appropriate committee would be one to look into current delays in meeting the road needs of today.

ENGINEERING NEWS-RECORD
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U. S. Signal Corps Photo

Fig. 1. Forms for the roof arches are carried on trussed falsework that is rolled forward on its own wheels.

Large Concrete Warehouses Built with Moving Falsework

***Contents in Brief**—Storage warehouses to add to the capacity of the Columbus General Depot of the U. S. Army are being built with reinforced concrete frames, thin barrel roofs of the same material and brick walls. Roof slabs and the supporting girders are being constructed on trussed timber forms that can be rolled ahead as the work progresses. The contractor's cycle of operations is set up to permit placing concrete in one section 80 ft. long each working day.*

REINFORCED CONCRETE is being used to build the new warehouses that the Quartermaster Corps, U. S. Army, is adding to the Columbus General Depot at Columbus, Ohio. Each structure is 182 ft. wide by 1,562 ft. long and has a reinforced-concrete frame carrying thin barrel-arched roofs and sidewalls of hollow brick. The roof of each warehouse is made up of four arches of 45-ft. span running longitudinally which actually are curved beams supported by reinforced concrete cross girders above the roof spaced 40 ft. apart. The girders in turn are carried on five reinforced-concrete columns, two in the outside walls and three on about 45-ft. centers across the warehouse. The design is patented.

Expansion joints across the structure in the center of alternate panels divide the roof into monoliths 80 ft. long except at the ends of the buildings, where the monoliths are 60 ft. long. The contractor's cycle of construction operations is based on completing the concreting of one of these 80-ft. sections each working day.

The thickness of the roof slab varies, being 4½ in. at the springline and continuing at that thickness up about 5 ft., then reducing gradually to 3½ in. at the thinnest point near the crown. There is no uniformity in the thickness as even at the crown it is varied to suit the amount of reinforcing in the slab.

Side and end walls between the columns are to be of hollow brick, 8 in. thick, carried on reinforced concrete gradebeams spanning between the columns at floor level. The columns are supported on spread footings about 10 ft. square that are founded on firm clay 7 ft. below floor level. Floors and loading platforms, both at car-floor level, are to be of concrete laid on gravel over the earth-fill. Face walls of the loading platforms are to be of reinforced concrete. There will be rail service at one side of each warehouse and truck service at the other. Roofs over the loading platforms are to be of timber construction supported by steel brackets hung from the concrete frame of the warehouse.

Firewalls of concrete block will divide the building into sections 120 ft. long, generally. Sash and doors are to be of steel, and the roof will be of 3-ply built-up asphalt construction. Monitors are being provided at the crown of the central arches and ventilators in the crown of the outer arches. Roof drainage is being provided by one downspout from each valley in the 80-ft. roof section, openings at the valley level being formed

through the concrete girders as they are poured. The downspouts discharge to cast-iron crossdrains below the floor which in turn feed into longitudinal storm drains outside the walls.

Lighting conduits for ceiling fixtures are imbedded in the roof slab as it is poured, but the main ducts for the electric system will be suspended from the structural framing inside the warehouse.

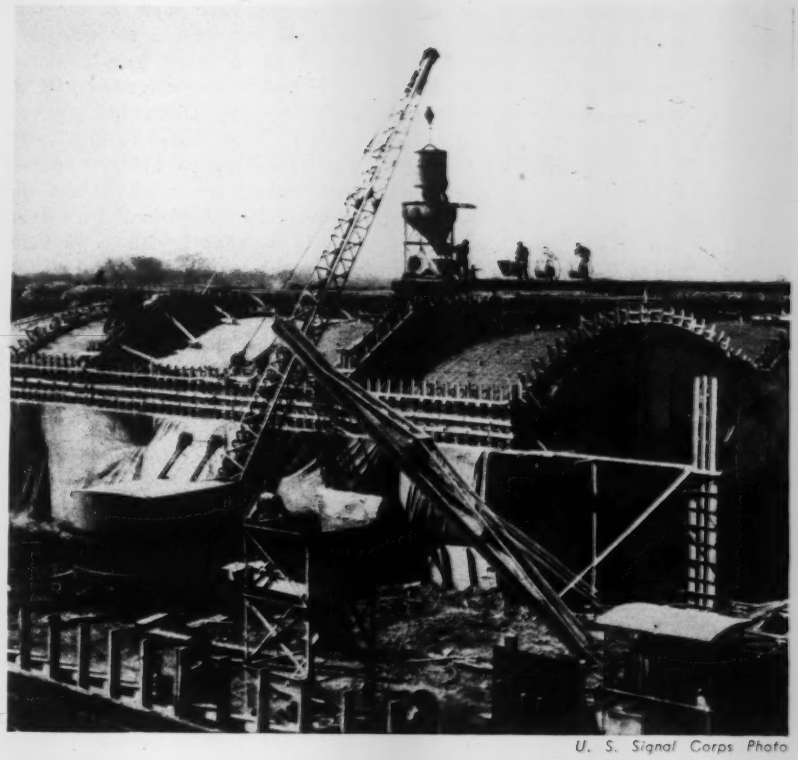
Construction operations

Current construction activity is centered on three of the 182 x 1,562-ft. warehouses which are being built on adjoining sites and thus are adapted to treatment as a single integrated construction operation. No major grading work was required as the site is fairly level.

The long axis of the three buildings lies roughly north and south. Six sets of traveling forms have been built, one at the south end and one at the center of each building, and all are being moved north, advancing as each 80-ft. section of roof is poured and cured sufficiently to carry its own weight. Each set of forms will make ten moves (including a 60-ft. end section), so that when the south traveler has reached the completed section at the center of each building, the center traveler will have reached the north end.

Footings and columns, which involve no large amount of concrete, are concreted some days in advance of the travelers, using normal portland cement delivered to the job from a local transit-mix plant. High-early-strength concrete is used for the roof and cross-girders, 335 cu.yd. being required for each 80-ft. section.

The cycle established for each traveler is as follows, beginning with a section ready for concrete: One day is required for placing concrete; two days are then allowed for curing; one day is required for lowering forms, moving ahead, adjusting the moving forms and building the sections that are not parts of the moving units; two days are allowed for placing the reinforcing steel, building the



U. S. Signal Corps Photo

Fig. 3. Concrete mixed by the paver in the right foreground is discharged into the hopper under the end of the inclined boom. From this hopper the crane delivers it to a smaller hopper on the movable buggy-run bridge on the roof.

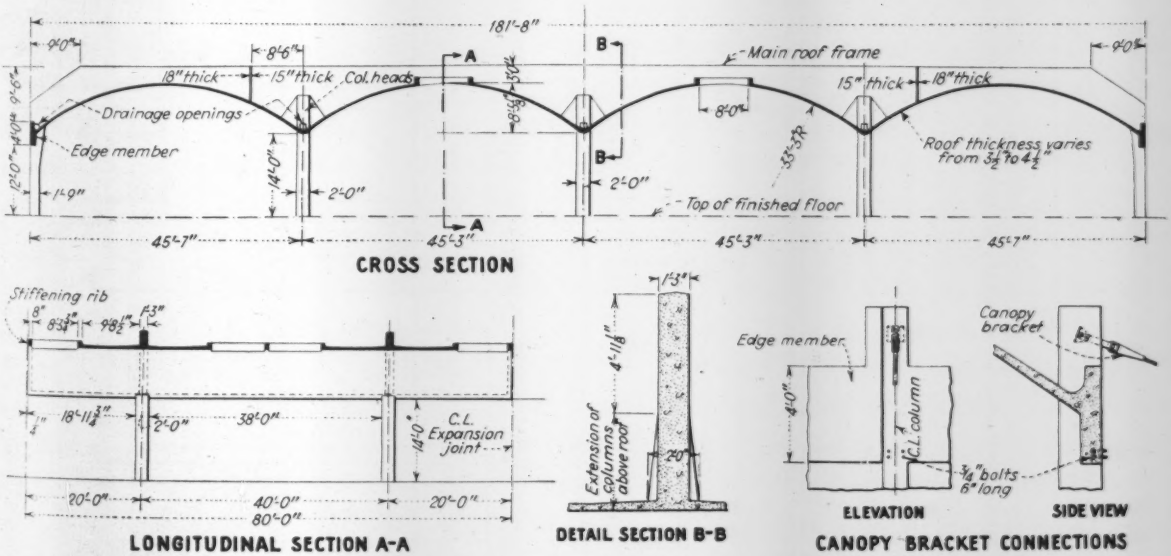


Fig. 2. The roof, though arched in form, is a thin concrete beam carried by heavy reinforced concrete girders spaced 40 ft. apart. Cantilever beams are used in the alternate sections containing the expansion joints.

girder forms that cannot be built until the steel has been assembled, and for setting up the concrete placing equipment—a total of six days. This work is being carried forward with one shift of from 10 to 12 hours, six days a week, with overtime paid for all work in excess of eight hours. With six travelers in service, this cycle makes it possible to place concrete in one section each day in the week.

The type of traveler is shown in Fig. 1. Its trussed bents are rigidly framed, using ring connectors, and when in position are supported on jacks resting on longitudinal rails accurately set to grade. The rails in turn are supported on track ties roughly set to the proper grade, heavy wood wedges between the ties and the rails being used to bring the top of rail to the required level. Flanged wheels in the lower stringers of the traveler rest on the rail when the jacks are lowered 4 in. for moving.

On three of the travelers, the bottom form for the arch is of $\frac{5}{8}$-in. plywood, and on the others hard fiberboard, $\frac{1}{4}$ in. thick, supported by 1 x 6-in. sheathing is used, all brushed over with a paraffin oil each time the forms are put into service. Of special note in the traveler design are the hinged sections at the outer edge that form the inner face of the spandrel girder and the adjoining parts of the arch at the springline. By being hinged, these sections can be dropped down to clear the columns as the traveler moves ahead.

At the intermediate valleys between the arches, the bottom form for the common point of the two arches is made of a No. 12-gage steel trough with its outer edges resting on the adjoining arch forms and supported by simple frames resting on blocks on the ground.

Forms for the columns, spandrel girders and gradebeams are of plywood built in sections that can be easily dismantled for re-use.

Arch concreting

An ingenious method of distributing concrete to all points in the roof area has been worked out by the contractor's engineers. It is shown in the drawing, Fig. 4, and in the photograph of the concreting operations. Low steel bents, framed as rectangular units 4 x 5 ft. in plan and 4 ft. high, which can be handled easily by a crane, are set along the top of the arch form at the crown of each arch. Rails secured to the top of these bents form a narrow-gage track along the crown of each arch, high enough to clear the cross-girders. These tracks in turn carry a transverse buggy bridge, spanning from crown to crown of the outer arches, which is mounted on flanged wheels so that it can be advanced along the axis of the building as the concreting progresses.

Concrete for the roof-building operation is mixed in a 1-yd. paving mixer that moves along the ground at the side of the building as the concreting progresses. It is served by trucks that bring four 30-cu. ft. batches of sand and gravel from a local gravel plant. They get their cement from a weigh-batcher centrally located on the job. During cold weather the sand and gravel were steam-heated at the gravel plant and hot water was delivered to the mixer from an oil-heated tank on the job.

Because of the thin sections in the roof and the large amount of reinforcing, no gravel over $\frac{3}{4}$ in. is used. Each 30-cu. ft. batch contains 627 lb. of high-early-strength cement, 1,476 lb. of sand, 2,052 lb. of gravel. The water-cement ratio is varied, a slump of not over $3\frac{1}{2}$ in. being required for the concrete going into the thin shell of the roof, and a somewhat higher slump being used for the heavily reinforced cross-girders. Concrete strengths range from 1,800 to 3,200 lb. in two days, which is the period allowed for curing before the forms are stripped.

The set-up for delivering concrete to the roof is as follows: The boom of the paver is set at an incline so that its bucket can be discharged into a collecting hopper which is used as a reservoir to level out irregularities in the operations. From the collecting hopper a crane swings a 1-cu. yd. bucket up to a small hopper set on the end of the buggy bridge. From this hopper concrete is delivered across the roof with hand buggies.

Concrete is placed first in the thin roof sections, beginning at the south end of one of the 80-ft.-long sections and working north. The low-slump concrete is sufficiently stiff to stand on the arch slopes without an upper form. First it is spread roughly as it is dumped from buggies operating on the overhead bridge and then it is worked down to the proper thickness, using wooden screed blocks set at frequent intervals over the roof forms to establish the correct thicknesses. Short handles cut in the blocks as they are formed permit their being lifted out as soon as the proper thickness is obtained, the hole being immediately filled with fresh concrete. Finally, finishers go over the surface with trowels to give it a rough-troweled finish. Paper collars are set around the legs of the trestle bents at

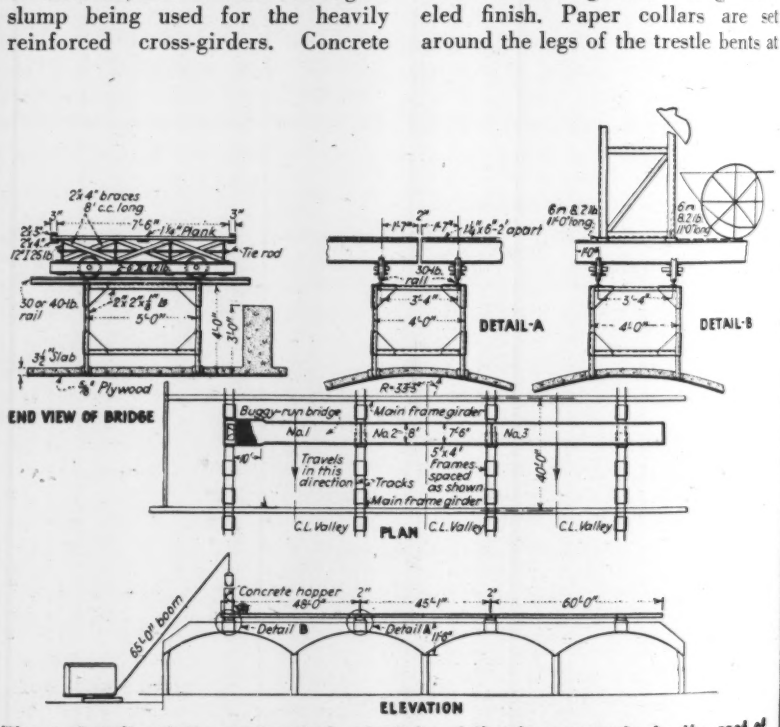


Fig. 4. Details of the contractor's plant for delivering concrete to the roof of the warehouses.

the arch crown, so that the bents will not be seized in the concrete. These are filled with concrete as soon as the trestle bents are lifted off.

The concrete in the arch roof is allowed to take its initial set before concreting of the cross-girders is begun. This seals off the open bottom of the girder forms where they intersect the roof and keep the concrete in the girder from working out into the roof area. Internal vibrators are used to get the concrete down into the reinforcing in the cross-girders.

During the cold weather, oil burning salamanders were set on platforms on the lower chords of the form trusses and canvas curtains were hung down over the ends of the forms so that the temperature of the air under the forms could be kept up around 90 deg. About a foot of straw was spread over the upper surface of the fresh concrete.

Organization

These additions to the Columbus General Depot are being built under the direction of Major A. F. Dershimer, Q.M. Corps, Constructing Quartermaster. Thomas E. Leahy is supervising engineer; A. F. Hubbard, construction superintendent; H. R. Kingsley, structural engineer; Wm. McClintock, field engineer; T. J. Van Arsdale, office engineer; and V. A. Harding, electrical engineer.

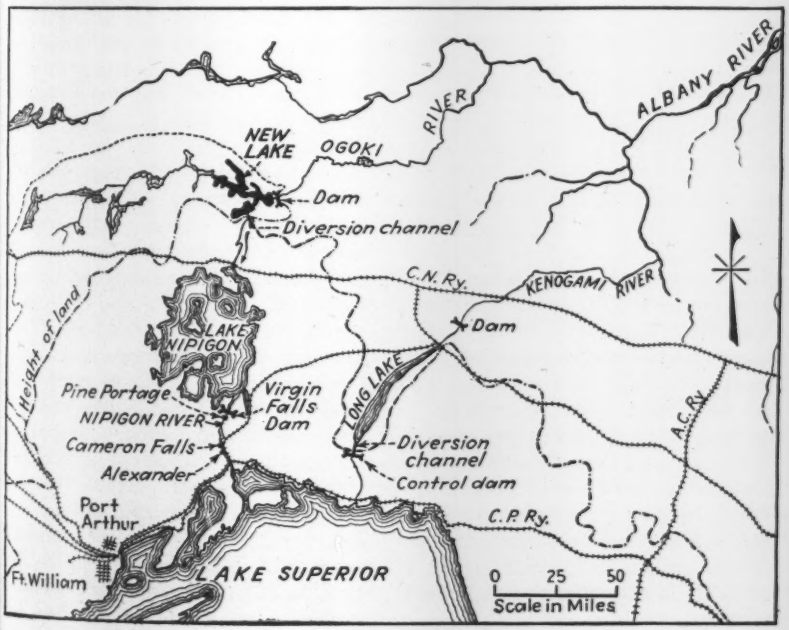
The general contract is held by the Corbetta Construction Co., New York, with Fred Narr, superintendent, and Charles Prokop, construction engineer.

Roberts and Schaeffer Co., Chicago, are holders of the patents on the roof design.

Ontario Begins Diversion of Arctic Waters

ACTING under an agreement entered into between the Canadian and United States governments in October designed to provide additional power for war industries in the Niagara district (*ENR*, Oct. 17, p. 508), the Hydro-Electric Power Commission of Ontario has begun work on a project to divert water from the Ogoki River, which flows northward into James Bay over the height-of-land and down into Lake Superior to offset an increase of 5,000 cfs. in the waters that Canada now diverts around Niagara Falls for power development. About 4,000 cfs. is to be diverted from the Ogoki, a tributary of the Albany River; 1,000 cfs. now is being diverted from the southern end of Long Lake, another tributary of the Albany River, to bring pulpwood down to mills on Lake Superior. The 5,000 cfs. to be diverted when the new project is completed has possibilities for producing 350,000 hp. in passing from Lake Nipigon and Long Lake down through the Great Lakes and the St. Lawrence River to tidewater at Montreal.

Water from Long Lake now is being diverted across the heights of land into a river flowing into Lake Superior, and work has been begun on a larger diversion scheme to bring water from the Ogoki River over into Lake Nipigon to increase the output of power plants on the Nipigon River, at Sault Ste. Marie, at Niagara, and along the St. Lawrence River.



As will be seen from the accompanying map, the height-of-land separating streams flowing south into Lake Superior from those flowing northward into James Bay, an arm of Hudson Bay, comes very close to Lake Superior at the southern end of Long Lake and lies quite close to the northern side of Lake Nipigon, a large lake that drains into Lake Superior. The general fall of the land to the north is very slight and the region is dotted with small lakes and criss-crossed with wandering streams. The possibility of diverting some of the waters that flow north into James Bay into Lake Nipigon and Lake Superior was brought to the attention of the Ontario commission in 1923, and in the following year surveys of the region were begun. As a result, it was found that by damming the Ogoki River at Waboose Rapids it would be quite feasible to turn the drainage from 5,800 sq.mi., estimated as 4,000 cfs., into streams flowing into Lake Nipigon. This water could not be used economically for power development on the Ogoki or Albany rivers, should power ever be needed in that remote region, as the fall from the proposed lake at El, 1,060 to tidewater in James Bay is only a few feet to the mile, with few points of concentrated drop.

The work now under way consists of construction of a main dam at the head of Waboose Rapids, 50 ft. high

and 1,700 ft. long, and two auxiliary dams to close off the low points in the reservoir area. These dams will create a reservoir extending upstream to the west a distance of 30 miles, and south into Mojikit Lake. A third dam across a creek flowing into Mojikit Lake also will be required. The raised water level will extend south into a small lake known as North Summit Lake and from there a channel will be cut across the height-of-land into South Summit Lake, from whence the water will flow into Seymour Creek and thence into Lake Nipigon. Channel work will be required at several points and control works will be built at the height-of-land. The work is estimated to cost $5,000,000.

Long Lake diversion

A similar diversion scheme at the headwaters of the Kenogami River was completed recently, chiefly for the purpose of floating pulpwood down into Lake Superior. A diversion dam was built across the river below the mouth of the lake and a diversion channel and control works were built at the south end of the lake so that water could be turned into the Aquasabon River which flows into Lake Superior. About 1,000 cfs. can be diverted by this route.

Potential power

From Lake Nipigon, El. 852, the Nipigon River has a fall of 248 ft. in 40 miles to Lake Superior, El. 604. The Ontario Hydro has a dam at Virgin Falls to regulate the flow from Lake Nipigon and two plants on the river, Cameron Falls, developing 75,000 hp. in a 75-ft. drop, and Alexander, developing 54,000 hp. in 60 ft. A third plant is projected at Pine Portage where 100,000 hp. can be developed in a drop of 105 ft. The 4,000 cfs. from the Ogoki River can be used to produce 90,000 hp. at these three sites, and 20,000 hp. can be produced by the water from Long Lake in its drop to Lake Superior. After entering the international waters in Lake Superior, the diverted water can be used to develop 10,000 hp. at Sault Ste. Marie, 150,000 hp. at Niagara, 40,000 hp. in the International Rapids of the St. Lawrence River, and 50,000 more in the section of the river in Quebec, a total of 360,000 hp.

Construction of the diversion work is being carried on at present by the forces of the Hydro-Electric Power Commission of Ontario under the general direction of Thomas H. Hogg, chairman and chief engineer, Toronto, Ontario. O. Holden is chief hydraulic engineer. A winter road was built to the sites of Waboose Dam and the control dam during the past few months and a considerable amount of construction plant and material was taken in so that construction can get under way actively in the near future.

Post-Emergency Public Works Planning

***Contents in Brief**—As a supplement to the formulation of a six-year program of public works, the National Resources Planning Board has completed a comprehensive study of the 1933-1938 works program and has formulated recommendations for "advance planning."*

LAST SUMMER, the President told the National Resources Planning Board to prepare a national six-year plan of public works, starting with the fiscal year 1941-42. Since that time programming of public works has become a matter for military rather than civilian planners, and NRPB consequently shifted its emphasis away from the immediate formulation of a plan. Instead, it attempted to analyze the works programs of the past decade in order to find out the most effective method of using public works to ease the economic and social shock when the armament program is over. The specific recommendations of the NRPB accompany this article. Below are summarized the views arrived at by the board as to policy to be followed in a post-emergency works program. To date, they are the only official expression of such policy.

Outstanding among the lessons to be drawn from the public works activity of the thirties is the wastefulness of a series of "emergency" programs, each based on the hope that unemployment problems would be soon solved. They resulted in a "deadline" type of administration under which projects had to be chosen primarily in accordance with the speed with which they could be started rather than on the basis of their value to the community. If a continuing policy had been established by Congress, projects could have been carefully chosen and designed, and the deflationary effect of periodic brief retrenchments could have been avoided.

Continuity of policy is especially important as regards federal financing of local public works. Ordinary municipal works are greatly dependent on the state of the municipal bond market. Hence, efforts of the federal government to expand public works in times of depression are likely to be thwarted by contraction of local works unless state and local officials know ahead of time what sort of aid they can expect from the federal government—whether percentage grants, loans, guaranties of bond issues, or what. Knowing this they can base work plans on the long-range financial resources of the community rather than on temporary economic fluctuations.

Flexibility in type and time

At the same time, if public works are to be used as a balance for the shifts of the business cycle, flexibility is a necessary element. This can be achieved both by eliminating some of the ordinary delays of starting up and by proper choice of projects. Thus land can be acquired considerably in advance of the decision actually to proceed with construction. Delays arising from starting work late in the construction season could be reduced if appropriation of funds for public works could be made the first order of business when Congress convenes in January.

Preliminary surveys and preparation of plans and specifications can also be prepared some years in advance of need if funds are made available. One way would be for Congress to establish a revolving fund from which allocations could be made to federal and other construction agencies, such allocations specifically not representing commitments ever to do the actual construction. Any losses incurred through doing preliminary work on projects never undertaken could properly be considered as insurance against emergencies—and would in any case be

less than the cost of being caught unprepared.

The time required for bid advertisement cannot easily be cut down much. Force-account work theoretically eliminates this, but when an organization has to be built up the delay involved is likely to be even greater than that required to use available private facilities. Where an existing force-account organization needs only to be expanded, work can be put under way very rapidly, if it is not necessary to arrange joint local-federal financing and if job seekers do not have to be qualified as to relief eligibility. This was demonstrated by the CWA in 1933, and the CWA formula provides a convenient way of bridging over the time needed to prepare for more solid projects.

A major factor in the flexibility of a program is the balance between large and small projects. The big projects are inherently slower to get started and, once started, take longer to build up to peak employment. Once under way, such projects are virtually impossible to halt quickly without serious loss. A well-balanced program might well consist of a limited number of large jobs to provide weight and solidity and a much greater number of small undertakings for flexibility. Flexibility is also improved by inclusion of a considerable amount of work of the type that can be done by the yard and stopped at any time without loss of the work already done—such projects as streets, roads, sewers, and the like.

Importance of such measures for increased flexibility is well illustrated by the experience of the thirties. Although $3,300,000,000 was made available in June of 1933 for public works, only $647,000,000 was actually expended in that calendar year, and expenditures only reached their peak in 1936, when $2,335,000,000 was spent. Thereafter, federal construction expenditures tapered slowly to $2,085,000,000 in 1938, when they began to rise again, first under the impetus of the 1938 PWA program and later of defense spending, to $2,281,000,000 in 1940.

As between the PWA and the WPA type of organization, there is little to choose as regards employment yield. The type of administration is of less importance than the project-composition of the program and the wage rates paid. Thus, allowing for the fact that about two man-hours of employment off the site were created by PWA for each man-hour of on-site work, the PWA non-federal program cost about $1.12 per man-hour. The WPA work-relief jobs, with about a sixth as much off-site as on on-site employment, cost $0.55 per man-hour. But if the analysis is confined to one type of project such as building, the cost becomes $1.00 for PWA and $0.73 for WPA, while if the WPA figures are corrected for the difference in wage rates the cost rises to $0.90 per man-hour.

NRPB RECOMMENDATIONS FOR ADVANCE PLANNING

1. Continued and invigorated efforts to secure the preparation of six-year programs or capital budgets by federal agencies, state governments, local governments and other agencies, public and private, anticipating a large volume of construction activity.
2. Development of alternative lists of projects included in six-year programs according to size of the project, types and locations of skilled and unskilled labor involved, materials needed, rapidity of beginning, and flexibility of termination—all in relation to employment stabilization.
3. Immediate inauguration of surveys, investigations and preparation of engineering plans and specifications for selected projects through allocation of aids to federal and non-federal agencies from a revolving fund to be administered by the President through his Executive Office; and reimbursed to the revolving fund as part of the cost of construction of the project.
4. Advance authorization by the Congress of procedures for grants, loans, guaranties of loans, leasing arrangements, or other devices for aids to state and local governments for non-federal projects for employment stabilization effective upon appropriation of funds by the Congress.
5. Advance authorization by the Congress of construction of federal projects in six-year program of "A" priorities. Such authorization should be effective upon appropriation of funds by the Congress, and not in itself involve any commitment for the immediate construction of the project.
6. Appropriation for advance purchase of sites of projects by appropriate governmental agencies.
7. Development of method of financing public works projects and studies of related problems of investment, taxation, and the federal, state, and local shares of responsibility for costs of various types of public works and related activities.
8. Coordination of public works construction at all levels of government, with other public policies which affect the level of business activity and employment, such as fiscal policy, social security policy, and policies of aid to private enterprise.

Not self-liquidating

Another lesson of the thirties is that no large works program can rely wholly upon strictly self-liquidating projects. This is demonstrated by the attempt in 1932 and 1933 to initiate an RFC-financed works program on a self-liquidating basis. Although $1,500,000,000 was made available for the program, only about $60,000,000 was ever actually used. The trouble is that only a limited number of projects of which individual use can be directly measured and which can therefore be operated on a price basis fall into the ordinary field of governmental activity. And many of the projects for which there is greatest social need cannot be made self-liquidating.

Because the benefits derived from many important community projects are very widespread, service-charge financing does not in general provide an equitable method of allocating the cost. In many cases, however, it is possible to achieve partial self-liquidation of public projects. This is true of such types of construction as municipal hospitals, low-rent housing, and navigation facilities. Moreover, there are types of work which have not ordinarily been public activities which could be undertaken during a depression and properly financed out of service charges. Public parking garages are an example. Excess condemnation, also, can be utilized to provide some financial return from projects of a type which increase the value of surrounding property.

Finally, an artificial sort of self-liquidation as far as the federal treasury is concerned can be obtained when the federal government builds a non-federal facility and leases it to a state or local agency on terms which amortize the construction.

In general, the experience of the past decade makes it clear that it is impossible to rely solely upon public works employment to compensate for the unemployment resulting from a major depression. As compared with unemployment of about 13,000,000 in 1933, the greatest employment resulting from federal activities, in 1937, was 3,500,000. An important contribution towards employment stabilization can be made by public works but they cannot do the whole job.

Hills, rocks and peat bogs of Massachusetts make unusual pipe line construction problems.

Pipeline Work in Rough Country

***Contents in Brief**—A 59-mile pipeline through New England's rocky hills and peat bogs presented some right-of-way and construction difficulties never encountered on lines in the South and Midwest. How these problems were overcome, from surveys to backfill, is described.*

CUTTING A GASH for a pipeline across Massachusetts from Fall River to Waltham proved very different from pipeline construction in the wide open flat country where most of the pipelines have been built. New Englanders were somewhat against the innovation, property records and maps were meager, and outcropping rock and adjacent peat bogs made excavation for the line hard going. Winter weather added difficulties during the entire construction period.

Surveys were expedited by aerial photography, opposition to the line was broken down by experienced right-of-way buyers and laying of the line was done by New England contractors who brought in experienced pipeline men and welders to supplement their own organizations.

The line has been built by the Shell Oil Co. to transport finished products, gasoline, fuel oil, and similar liquids. These products come into the inland harbor at Fall River by tanker from the Gulf or West Coast and are stored in a tank farm there which was constructed as part of a refinery that is not at present in operation.

The transport line is a 6⅝-in. O.D., 1,300-lb. hydrostatic test, seamless tubing with ¼-in. walls and is expected to carry 10,000 bbl. per day at 1,000 lb. per sq.in. initial pressure at the one pump which is located at Fall River. Only relatively small storage will be maintained at the discharge point, Waltham, near Boston, 59 miles from Fall River. The Waltham terminal will permit serving metropolitan Boston by hauling only the products used locally into the downtown area rather than hauling everything away from the congested Chelsea docks as has previously been necessary.

Aerial surveys

No general land maps of the New England area are available so almost the first activity was an aerial survey about 3 miles wide along the anticipated route the pipe might follow. This survey was plotted on sheets covering 3 by 5 miles. On these several tentative lines were laid out, attempting to bypass developed areas and natural obstructions. Ground parties followed out the most promising lines, securing the names of owners of the traversed property, as few maps exist in New England showing the owner of a particular tract or even the outlines of individual properties, and all descriptions are by metes and bounds.

Under the individual's name some record of the boundaries was available but as many properties had not changed hands in years the boundary marks could not be easily reestablished. A prize description was worded "From the SW corner of the Necessary along the stone wall to a beech tree—," none of which now exist.

The line was laid out to avoid developed areas and the more difficult natural terrain. Towns and open water were generally bypassed but it was not practicable to attempt to go around swamps or rocky land.

As soon as the approximate line was determined right-of-way men attempted to get easements for the right to construct and permanently operate and maintain the line. The width desired is about 2 rods, although in some cases the only easement right obtainable prevents the cutting of any trees thus making hand work mandatory. Property owners retain all rights above and below the line but are expected to keep buildings a few feet away from it. An average of 6½ easements per mile were required. Outright title was taken only at terminals and at points where access to valves was required.

Bends are frequent

In securing easements the owners are shown, in the field, about the route that the line will follow, with assurances given that it will be routed around larger trees and kept out of landscaped areas. This has required some bends in the line, but as they can easily be made by the method used in laying, and since easements were obtained more readily as a result, the line is far from straight. Horizontal bends are much less frequent and severe than the vertical ones, which are required to follow the contour of New England terrain.

Next operation was staking of the line by a transit party with actual running out of all boundaries of property crossed by the pipeline. These property lines were all plotted on uniform size maps and filed with the proper local authorities as the nucleus of complete maps desired for general use in the area.

"Stovepipe" method of construction is used. A clamp holds the pipe aligned and properly spaced while first bead is run in.

Coated pipe

Pipe was fabricated in double random lengths (about 40 ft.) and that to be used in bog areas was coated in the mill with ⅛-in. asphaltic protection and then paper-wrapped. The pipe was shipped by rail and delivered by trucks to the point of use. As the pipe weighed 700 lb. per length, a truck crane was used to transfer it from the railroad cars, but unloading along the line was done by rolling the pipe down skids, using a snubbed rope as a brake.

The terrain in the section traversed is unusual as rocky hills

An auger is used to assist pushing a 10-in. casing for the pipeline 90 ft. under four tracks of the Boston & Albany R.R.

give way in a few feet to deep peat bogs and swamps. About 10½ miles of the 59-mile length crossed these bog areas. Two rivers, 17 railroad and 97 highway crossings added variety to the construction work.

Trench preparation

About 80 percent of the line traversed is timber land and 25 miles required removal of large boulders or ledge rock. Drilling and blasting were used for much of this, supplemented by pneumatic breakers especially in well developed areas. Air was supplied by truck and trailer-mounted compressors.

Through a peat bog where corduroy roadway was built to move equipment.

Trench size desired was about 18 in. wide and 30 in. deep, there being no reason to attempt to get below frost. Excavation was done largely with backhoes, 15 being in use at one time, ranging in size from ⅜ to ¾-cu.yd. capacity. The smaller machines were most satisfactory but all machines available along the route were put in service. Machines each dug 800 to 2,200 ft. per day, depending on the terrain, leaving the dirt along one side for backfill. Across the swamp areas small trees were cut for corduroy or the machines carried large timber mats which were used to distribute their weight.

Most of the clearing was done by bulldozer, and backfill, following the laying, was generally accomplished by this same equipment.

River crossings were made by trenching across the bed with a clamshell bucket on a floating rig. The welding equipment and pipe were put on the derrick barge and welding done on the deck, the derrick swinging pipe out to the banks on either side while lines to the bank held the pipe and barge in position. Pipe was buried well below any possible future

Sleds were found more satisfactory than wheels for moving welders along the pipeline. Two 200-amp. gas-driven electric arc welders are used as a unit.

dredging, with approach trenches cut deep to permit easy bends over the banks. The Assonet River crossing is over 600 ft. wide and the Taunton River 176 ft. wide, the latter requiring 9 ft. of excavation to a depth of 18 ft. below mean low tide.

Highway crossings were generally made well in advance of the pipeline crews by putting in a pipe casing, larger than the line, then threading the line through this. On roads with other than rigid paving, where traffic could be partially blocked, open cut excavation was used to permit laying an 8-in. casing. On main highways and railways the casing was jacked under the road, a 10-in. casing being used to permit more play on long crossings.

Special crawler tractors with side-mounted booms, counterweighted to prevent overturning, handled the pipe in the field, and two of the rigs working together bent the pipe to the required contour of the ground.

Laying procedure

The laying and welding operation was combined as the "stovepipe" method was used, i.e., sticking one piece of pipe onto another rather than the method of laying several sections together on rollers and welding the pipe as it is slowly rolled around. The rocky, uneven terrain makes the latter method difficult, and advances in electric arc welding make the "stovepiping" practical. Step by step procedure was as follows:

1. Pipelaying machine, "boom cat," picks up length of pipe, swings it in contact with the preceding pipe, where it is clamped in alignment.

2. Laying machine holds pipe while two welders put on a stringer bead with ¼-in. rod, resulting in full depth penetration.

3. The two pipe laying machines work together to bend the pipe as required to fit the terrain. The pipe is bent so that it always lies high in the trench over the ridges, low in the valleys, and, on horizontal bends, on the side of the trench to give most slack under temperature drops.

4. The second bead is put on with a $\frac{5}{32}$-in. rod and the third, and finish bead, with $\frac{3}{16}$-in. rod. The rods used are shielded arc type specially designed for vertical and overhead welding.

5. Backfill is done by bulldozer, by hand, or in some instances by a horse-drawn Mormon board scraper.

Equipment for one crew included: two pipelaying tractors; a utility tractor; two 200-amp. gasoline-engine-driven electric arc welders mounted on each of two sleds; a utility truck with an arc welder and oxyacetylene equipment including a circular cutter designed to make a neat bevel cut on the pipe where necessary to use less than a full length.

A crew consisted of five welders and five helpers, three tractor operators, one spacer and line-up man, five men laying pipe, three men behind lowering into the trench, two truck drivers, a foreman and two sub-foremen.

Welding of the pipe was normally done entirely above the ground, the pipe being supported above the trench on 3 x 4 timbers, the welders often standing in the trench to get at their work more conveniently. This method eliminates excavation of a bell hole to give working room.

Normal operation was for two welders to work with the laying crew putting on the first bead while the pipe was held in position by the crawler machine and clamp. This first bead is sufficient to hold the pipe during bending and connection of successive pieces. Following by a few joints, two more welders put on the second and third bead. The pipe is then lowered into the trench by a side-mounted boom on a tractor.

At road crossings a length of pipe was started into the casing under the road and one or more lengths welded to it until sufficient pipe was beyond the culvert to permit pulling the end above the ground level for easy welding. The welded connection at the rear was the only point which required a bell hole for welding and even this was often avoided. Where jacking under the surface was necessary an auger was pushed forward by jacks while being turned, thus filling the auger which was then withdrawn and emptied. A casing was shoved into the opening as soon as it was started, and subsequently was kept about even with the auger, especially when cutting under important railroad tracks.

Laying the line was handled by two full crews and a smaller auxiliary crew which handled river and special sections separate from the rest of the organization. Thus only a very few cuts on pipe were necessary in the field as no fittings were used except a valve at river crossings and one Y-connection.

Organization

General supervision of design and construction of the line was handled by R. B. High, vice-president of the Shell Pipe Line Corp., who supplemented the eastern organization with men from the Texas oil fields. Heading the engineering and construction supervisory forces was W. H. Shelley, superintendent of the West Texas and New Mexico area; first assistant was C. W. Marquis, construction superintendent of what Shell Pipe Line Corp., calls its Texas area; Ross Lahr, with a title of corrosion engineer, handled technical problems; F. B. Estes had charge of location and procuring of the right-of-way for the line.

Construction of the line was done under a contract with Lane Construction Co. of Meriden, Conn. Under Mr. Hayden, superintendent, they cleared all of the right-of-way, excavated the line for its total length and made the backfill. Actual laying and welding of the line was sublet to C. N. Flagg, also of Meriden, Conn., for whom S. R. Joslin acted as superintendent.

How Sanitary Engineers Function In Our Army Organization

***Contents in Brief**—Army training camps with their huge aggregation of men have problems in sanitation akin to that of big cities. Operation of facilities for water supplies, sewage treatment, refuse disposal and mosquito control requires supervision by specialists in the Sanitary Corps. The following outlines the organization, activities and personnel of this important unit in our national defense program.*

ENGINEERS of the Sanitary Corps are in action at army training camps to aid in the specialized services of caring for thousands of men living in concentrated centers of population. In many respects an army camp is akin to a well-organized city and like the city, it has its problems pertaining to water supply, sewage treatment, refuse disposal and a host of other services related to health and wellbeing. The engineering and supervisory phases of these problems are a responsibility of the Sanitary Corps, a little known but highly important unit in the army organization.

To understand the place of the Sanitary Corps, we need only to project the analogy of cities with camps. A city administers its manifold activities under the general direction of a city manager or a mayor; a camp is operated in the same way by the commanding officer. The city requires technical advice from sanitary engineers in regard to water supply and purification, sewage treatment, waste collection and disposal and mosquito control. In the operation of a camp, the commanding officer requires similar advice, and he calls on his service, or technical staff for it. All matters relating to health lie in the province of the camp surgeon, and on his staff are placed one or more Sanitary Corps engineers to advise him, and through him the camp commander, on those details.

The functional organizational pattern works out like this: Under army regulations the medical department is charged with responsibility "for the protection and conservation of health and physical fitness of the troops." To carry out this broad responsibility the medical department organization includes the following functional corps classifications: medical, dental, sanitary, veterinary, medical administrative, nurse and enlisted personnel. In this set-up the Sanitary Corps is designed to supply specialists in activities outside of normal medical, dental, and veterinary fields of practice, as for example, sanitary engineers, entomologists and laboratory technicians.

Col. W. A. Hardenbergh, chief of the Sanitary Engineering Section

So much for functional classification. In actual operation the sanitary engineering section is part of the subdivision of preventive medicine in the office of the surgeon-general of the army. The work of the subdivision includes such activities as general sanitation, sanitary engineering, laboratories, industrial hygiene, research and control of communicable diseases. The Sanitary Corps is called upon to furnish all personnel in sanitary engineering, many of those engaged in laboratory operations and also men in other fields of activity. The total includes almost 500 men, all of whom are commissioned officers ranging in rank from first lieutenant to colonel.

In about 50 army camps with 10,000 or more population the Sanitary Corps already has assigned engineers, and more are being ordered to duty daily. Typical duties and responsibilities of an engineer at a camp are these:

Water Supply—Checks operation of treatment plant to see that no hazard exists and that a safe and palatable water is being produced. In field exercises the sanitary engineer advises on procurement and treatment of water and makes arrangements for necessary analysis of samples; he may also supervise field purification and assist in locating the source of supply when in the field.

Sewage Disposal—Checks operation of collection and treatment facilities and is constantly on the alert to see that no dangers exist from stream pollution which may arise because of inadequate treatment.

Mosquito Control—Makes surveys and plans for the installation of control measures, and exercises supervision over the construction of control works, though the work itself is usually executed by the Constructing Quartermaster.

Refuse Disposal—Checks and advises on the operation of collection methods and incinerator operation or other waste disposal methods. An important phase of this work concerns itself with the elimination of rats, flies, mosquitoes, and any other nuisances which might involve a health hazard.

General Insect Control—Advises on the control and elimination of bedbugs, lice, cockroaches, and crickets.

Swimming Pools—Supervises their operation and maintenance.

In general, the sanitary corps officer serves as the engineer-adviser to the camp surgeon, who has the responsibility for recommending measures necessary for the protection of health; but the commander of the post, camp or fort is responsible for ordering that these measures be carried out.

Who is in the corps?

At the time of this writing (Mar. 1) there are 475 men assigned to the Sanitary Corps. Of the total, 125 are classified as engineers, 180 are laboratory specialists, and the balance consist of specialists in such varied fields as sanitation, non-medical public health, hospital architecture, medical supplies procurement and nutrition.

Practically all of the Sanitary Corps personnel are recruited from civil life, many of the men having been identified with the corps as reserve officers. To be eligible for the corps the applicant must have had four years of college training (this is waived under exceptional conditions) and at least three years of professional experience in a special field of work. Successful applicants are commissioned immediately as first lieutenants.

At the present time the issuance of commissions has been suspended but it is possible that appointments will again be resumed when present personnel has been utilized. When this will be is uncertain. In the meantime a file of qualified men is being maintained.

General activities of the Sanitary Corps are under the direction of Col. W. A. Hardenbergh, who is Chief of the Sanitary Engineering Section, Subdivision of Preventive Medicine, Office of the Surgeon General. Col. Hardenbergh, a reserve officer for many years, was ordered to temporary duty last summer and brought back into the service in October for extended active duty. Assisting in the field are a number of engineers assigned to the various corps areas, thus permitting a decentralization of the work and consequent greater effectiveness.

Among the well-known engineers now on active duty in the Sanitary Corps or under orders to report are: Lt. Col. M. J. Blew, sanitary engineer of Philadelphia, assigned to the Fourth Corps Area, with headquarters in Atlanta, Ga.; Lt. L. K. Clark, state sanitary engineer of North Dakota, assigned to the Seventh Corps Area, Omaha, Neb.; and Capt. E. S. Hopkins, filtration engineer of Baltimore, assigned to the Third Corps Area at Baltimore.

Others not yet called for duty include: Major W. H. Weir, Georgia state board of health; Major A. S. Behrman, International Filter Co., Capt. A. E. Stilson, Morse-Boulger Destructor Co., N. Y.; Capt. Chester Cohen, Texas state board of health; and Lt. Col. Ralph Sweeney, N. Y. State Dept. of Health. Major Geo. Parker, formerly state WPA director for Mississippi, has been loaned to the Quartermaster Corps and is on duty in Washington. David B. Lee, recently appointed state sanitary engineer of Florida, is also a member of the corps.

Spring-Steel Brackets for Timber Guardrail

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Oregon State Highway Commission

***Contents in Brief**—A guardrail design in which timber rails and posts are connected by a spring-steel mounting has been selected for Oregon highways and a section built in the Salem yard was subjected to a series of impact tests. Specifications for the spring-steel are important.*

Out of Experience in Oregon with various types of highway guardrails has come a timber design employing a simple spring-steel support which has been chosen as affording maximum safety as well as simplicity and low cost. To obtain a definite check on the good performance expected, a short section of guardrail using this design was constructed at the equipment yard in Salem and a series of impact tests were made with a heavy truck striking the rail at different angles of incidence and at different speeds. Notes on these tests, together with details of the new design, are given in the following.

When the search for the best type of guardrail began, metal, concrete and timber construction were considered. The plentiful supply of structural timber available locally gave this material special advantages and the study soon focused on the most effective timber design, particularly the method of attaching a horizontal rail to posts with a type of connection that would have the necessary strength without undesirable rigidity.

Early designs utilized an 8x8-in. post, with chamfered tops carrying a 3x8-in. horizontal rail. As heavier construction was made necessary by higher speeds, post sizes were increased to 10x10 and double-ply 3x10-in. horizontal rails were used. Experience with this design, however, demonstrated a lack of desirable flexibility.

About a year ago a metal bracket was interposed between the posts and the rail member. This gave the required resiliency and it was found that with proper care in selection of the steel for the spring, all strength requirements could be met. Accordingly, specifications were worked out for the most effective bracket in a mounting of the simple form shown in the accompanying drawing. This bracket is spring steel (S.A.E. 1095) 4⅞ in. wide and $\frac{7}{16}$ in. thick. It has a die-formed bend of such shape that the outer face is 5½ in. from the face of the supporting post. Specifications for the springs are as follows:

"They shall be heated in a gas-fired, automatic, temperature-controlled furnace equipped with automatic proportioning inspirators and tunnel-type burners. After carefully heating at 1,475 deg. F. to 1,500 deg. F., they shall be quenched in circulating, tempering oil of 100 viscosity at 100 deg. F. with cooling devices whereby the temperature of the oil remains constantly at 95 deg. F. to 105 deg. F. After the quench, they shall be drawn two hours in a gas-fired, convection-type, heated-conveyor, draw-furnace equipped with automatic temperature controls at 900 deg. F. or until a Brinell hardness of 341 to 388 is obtained. The brackets after the draw shall have a tensile strength of 160,000 lb. minimum. The brackets shall be die-formed and holes punched hot."

In the tests made in the Salem yard, a truck weighing 8,850 lb. was driven against the section of guard-

rail at angles of incidence ranging from 15 to 45 deg. and at speeds of 5 to 20 mph. The following is a summary of results.

Results summarized

1. At small angles of incidence, elastic rebound was sufficient to deflect the truck into a position roughly parallel with the fence. As the angle of incidence increased, the horizontal timber rail failed under impact.

2. Brackets and the timber beam both deflected noticeably under load but returned to their original position for all loads that did not cause failure of the rail.

3. Vertical posts were displaced by collision and showed but little elastic recovery, even under the low speed impacts, and smaller angles of incidence.

4. The steel brackets showed market deflection in all cases although in the lighter impacts they were not forced against the posts. For the higher speeds and larger angles of incidence, the vertical posts were definitely indented or marked by the deflecting brackets, indicating that the full spring effect had been used.

5. The $\frac{5}{8}$-in. bolts that fastened brackets to posts appeared adequate in tension; however, a noticeable crushing of the timber was observed under washers on the rear face, indicating need for a plate washer large enough to insure better bearing.

As the series of tests was rather limited in scope, definite conclusions should not be made too sweeping; however, an analysis of observed results, in connection with the service record of the various field installations, warrants the following general statements:

At the instant of heaviest impact, the steel spring is completely deflected, as shown. In this collision the rail member was shattered and the vertical posts deflected sharply backward.

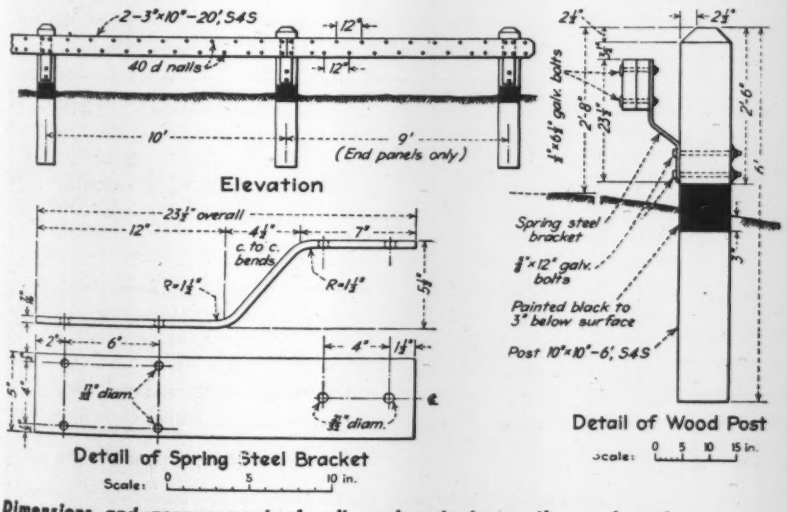
1. Because of its greater visibility and strength, the 6x10-in. horizontal rail member consisting of two plies of 3x10-in. plank is the preferable rail construction.

2. Use of the spring-steel-bracket mounting is warranted because of its distinct shock-cushioning advantage. The action of the brackets in deflecting the path of the vehicle into approximate parallelism with the fence line is a distinct advantage and safety measure. Also, this type of mounting transmits and distributes impact stresses to a number of posts.

4. The attachment of the spring brackets to the vertical posts at a point close to the ground tends to reduce bending moment in the posts.

5. The marked displacement of the vertical posts (which appeared roughly proportionate to impact) emphasizes the need for extreme care in setting them in the ground. For some time an asphaltic gravel mixture has been used in Oregon for backfilling around guardrail posts and results indicate that such a precaution is warranted.

R. H. Baldock is state highway engineer of Oregon.



Dimensions and arrangement of rail, spring-steel mounting and posts.

Asphaltic Surfacing For Battledeck Panels

After three years of service a $\frac{3}{8}$-in. asphaltic surfacing on a steel battledeck floor panel on a main roadway at the Bethlehem Steel Co. plant is reported in very satisfactory condition. The panel consists of a $\frac{1}{16}$-in. plate on top of 12-in. standard 31.8-lb. I-beams on a 26-in. spacing. Condition of the surfacing is described in an American Institute of Steel Construction report dated February, 1941, and titled "Second Progress and Trial Report of a Traffic Test of a Thin Asphaltic Surfacing for Battledeck Floors for Highway Bridges."

The conclusion reads, "The opinions of those who have inspected the plate recently were that it was in excellent condition for the type of surface used; and that, if it continues to perform as it has to date, it should provide a bridge floor surfacing as satisfactory as any bituminous roadway covering and no more expensive to maintain. The steel battledeck floor unquestionably provides a superior type of foundation for such a covering.

New Type Suspension Bridge Proposed

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***Contents in Brief**—Addition of pre-stressed diagonal hangers to models of Tacoma and San Francisco Bay suspension bridges damp out undulations and vibrations from dynamic loads to small fraction of amplitudes created in models of original design by same loadings. Tests indicate new conception of suspension bridge design.*

SINCE THE FAILURE of the Tacoma Narrows Bridge last fall, model tests have been conducted at Northwestern Technological Institute to study the dynamic stability of suspension bridges under various loading conditions. Most startling of all results of these tests is the manner in which pre-stressed diagonal hangers, added to the conventional cable-vertical hanger-stiffening-truss arrangement, transform the flexible cable system into a rigid structure that defies all efforts to build up a vibration amplitude or undulation. The cable stiffening, designated as a three-member hanger, consists of diagonal cable hangers leading from the top of each vertical hanger at the main cable to the lower end of adjacent vertical hangers at the stiffening truss connections. In the tests, these diagonal hanger members were prestressed so that they were always in tension.

The three-member hanger system was found to effect such a rapid damping out of vibrations due to dynamic loads that it would probably be impossible for any sequence of resonant wind impulses to build up a vibration amplitude of any importance in a full-size structure. The cable, instead of acting as merely a flexible member from which a stiffening truss is hung, acts as the top chord of a truss of depth from cable to roadway under the unbalanced effect of moving live loads or dynamic wind impulses.

Models used

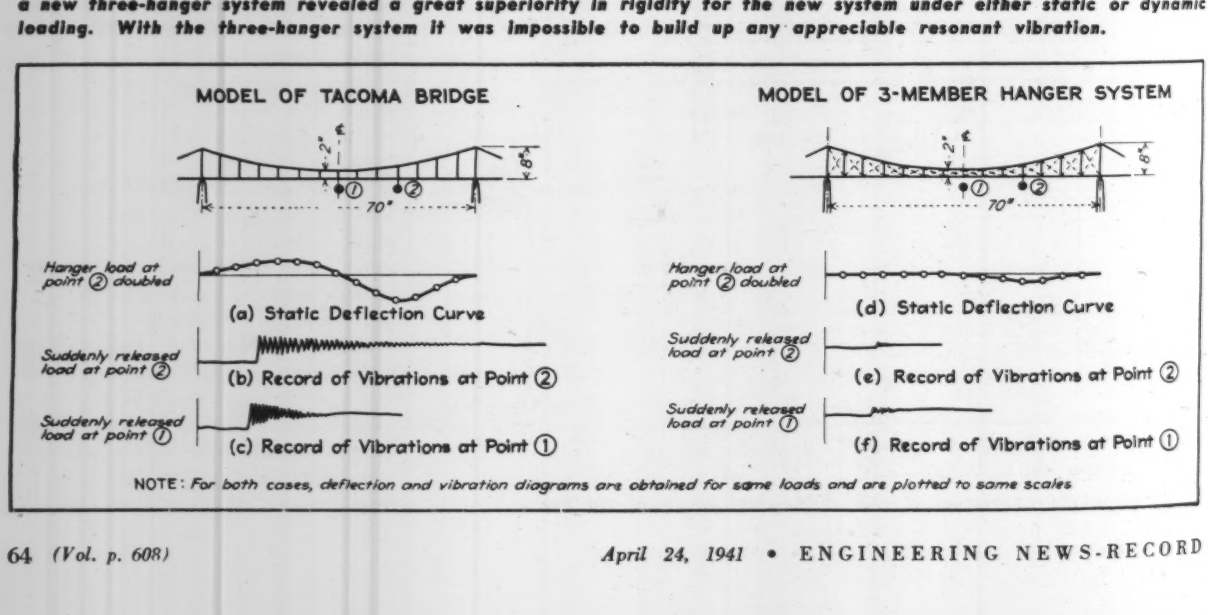
Static and dynamic load tests were made on two models. One was a scale model of the Tacoma bridge main span with only an approximation of the horizontal motion of tower tops resulting from side span flexibility. The other was a much more complete model of the San Francisco Bay bridge with side spans. In the case of the Tacoma bridge the load concentration used for the test was 1/14 and for the Bay bridge 1/10, of the total main span dead load. This was the load used for a comparison of static deflection curves, and was also the suddenly released load used for a comparison of vibration damping forces inherent in the common single hanger system with those of the multiple hanger system.

Test methods and results

The suddenly released load gives a theoretical starting amplitude range of twice the corresponding static deflection and represents a tremendous dynamic load. For the Tacoma span it would mean a simultaneous and sudden release of more than four complete hanger loads or the instantaneous release of more than 200 lin. ft. of roadway.

Records of static deflection and dynamic vibration for the Tacoma model with ordinary hangers are sketched below (*a*, *b* and *c*), and

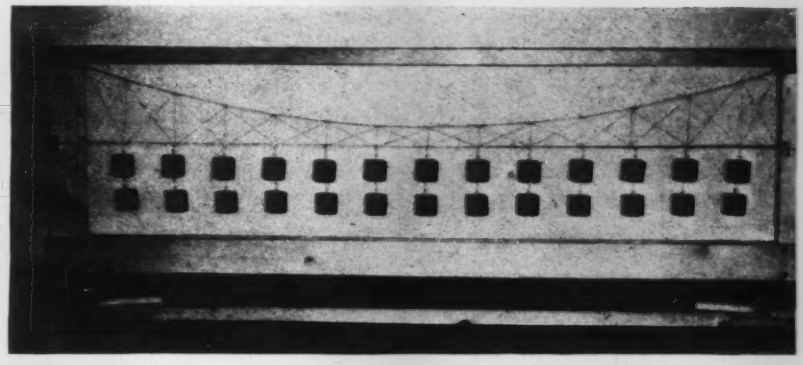
Comparative tests of models of Tacoma Narrows main span fitted respectively with conventional vertical hangers and a new three-hanger system revealed a great superiority in rigidity for the new system under either static or dynamic loading. With the three-hanger system it was impossible to build up any appreciable resonant vibration.

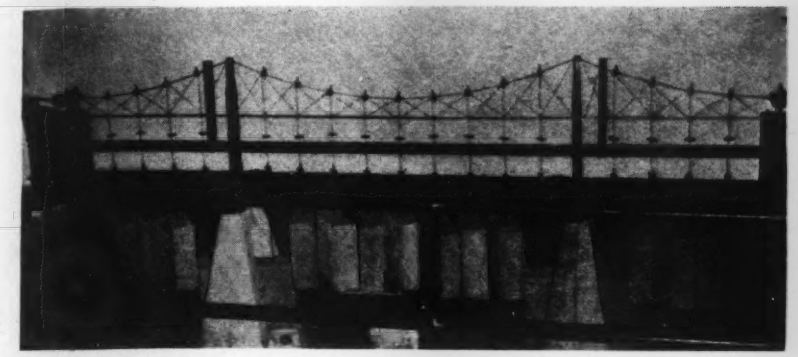

MODEL OF TACOMA BRIDGE
MODEL OF 3-MEMBER HANGER SYSTEM
2"
8"
70"
Hanger load at point ② doubled
(a) Static Deflection Curve
Suddenly released load at point ②
(b) Record of Vibrations at Point ②
Suddenly released load at point ①
(c) Record of Vibrations at Point ①
Hanger load at point ② doubled
(d) Static Deflection Curve
Suddenly released load at point ②
(e) Record of Vibrations at Point ②
Suddenly released load at point ①
(f) Record of Vibrations at Point ①

NOTE: *For both cases, deflection and vibration diagrams are obtained for same loads and are plotted to same scales*

Model of Tacoma Narrows Bridge (right) which revealed stability afforded by diagonal cable hangers added to conventional design. Top strut stiffens towers, compensating for omission of side spans.

Model of San Francisco Bay Bridge (below) was tested to prove diagonal hanger system works on side spans as well as long center span.





with the three-member hanger system (*d*, *e* and *f*). A comparison of the static deflection curves *a* and *d* shows: (1) how much those deflections are reduced by the new hanger system and (2) how the typical tendency toward negative or upward deflections in the conventional model is eliminated by truss-type action of the model with the three-member hanger system.

A comparison of the vibration records, particularly a comparison of vibrations with node at center, which is the basic type of cable vibration causing failure, show how rapid is the damping out effect of dynamic loading. (Compare vibration records *b* and *e*). It is reasonably certain that no wind or other dynamic load could build up an appreciable resonant vibration in the model with the three-member hanger system.

Extended conclusions

As a result of these model tests of what must be considered a new type of structure, with suspension bridge economy for long spans combined with continuous truss rigidity, the following conclusions are justified:

(1) There would be no more danger of dynamic instability in a suspension bridge with this hanger system than if the structure were a heavy and rigid three-span continuous truss.

(2) This hanger system makes the suspension type applicable wherever a three-span or multiple-span continuous truss could be used. Its rigidity eliminates the need for any stabilizing ratio of live to dead load. The new multiple member hanger system would provide the great economy of the suspension type without the need of stiffening truss or large dead load for rigidity.

(3) A three-span continuous suspension bridge like the one considered, but not used, for the San Francisco Bay crossing becomes a possibility. In that case the whole cost of the anchorage in the center of the middle span could be eliminated with smaller deflections than now occur.

(4) The stressing or prestressing of this novel hanger system offers no problem since it is done merely by the act of carrying the load of the floor system.

(5) The change in the structural action of the cable which is transformed into the top chord of a continuous truss for a part of the live load effect is almost as surprising as the tremendous damping increment produced by this hanger system as compared with ordinary damping effects. The structural action is easily explained and the dynamic action is typical of that in trussed bridges.

(6) The cost of the three-member hanger system would increase the total cost of the bridge by not more than one per cent.

May omit vertical hangers

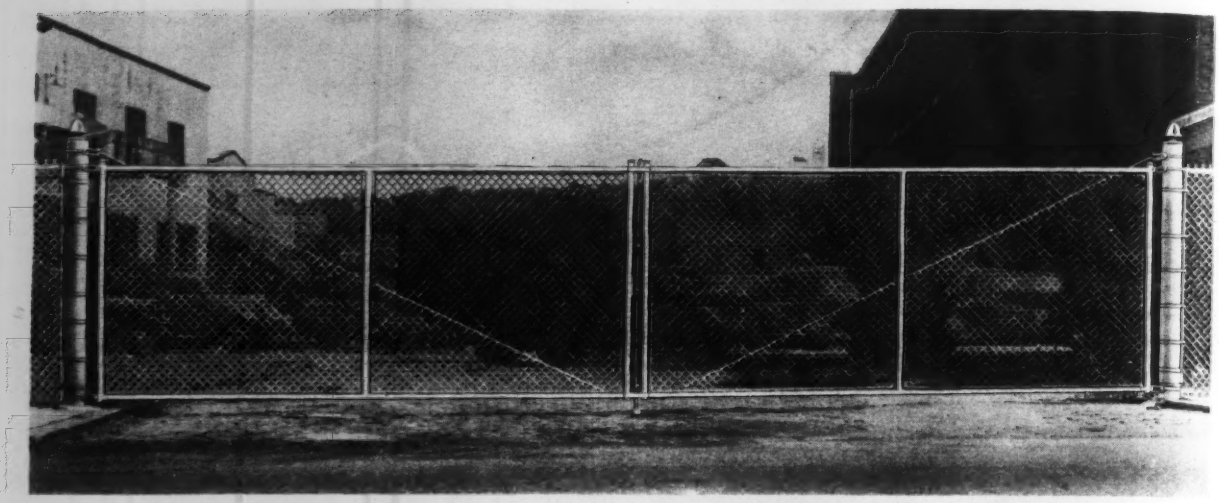
Experiments were continued on the Tacoma bridge model to determine the effect of using diagonal hangers only, omitting the conventional vertical hanger. The results were satisfactory, though the damping effect was slightly less than that of the three-member hanger system. However, the tests indicated diagonal hangers alone would serve very well under many design conditions.

The stressing, or rather, prestressing of all the elements of the hanger system can be done in either a statically determinate or a statically indeterminate manner. In either case, the erection of the roadway causes tension in the various elements of a multiple member hanger which may be regulated to the same unit value for all elements, as would be the case if the customary single vertical hanger were used.

It is essential that the prestressed web system created by the intersecting diagonal elements of adjacent hanger units be continuous throughout the whole length of the main cable.

The most novel feature of this arrangement is a deep stiffening truss web system where the chord increments due to a part of the unbalanced live loading are provided by the existing main cable and roadway side girders.

The stiffening truss as such becomes no longer necessary and for a small part of the saving due to elimination of the average size stiffening truss, a continuous truss is provided with an entirely different and greater order of stiffness.



Double-swing-type gate which furnishes an unusually large opening for the passage of large vehicles.

Fundamentals of Protective Fencing

R. D. Logee

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***Contents in Brief**—Many engineers are confronted today with the necessity for building fences. Here are practical answers to a number of questions concerning the height, location, spacing of posts, attachment of barbed wire and the use of gates for such an installation.*

FACED WITH THE PROBLEM of erecting a fence for protective purposes, plant and municipal engineers profitably may draw upon the experience of fence specialists. Down through the years much practical information has been assembled bearing on the selection and installation of fences, a brief summary of which may prove to be helpful at this time.

Conditions at present lend a special desirability to the installation of fencing to curtail unwanted intrusion. In the case of a water supply system the entire watershed should be fenced if at all possible, and reservoirs should always be fenced with the additional safeguard of thorough floodlighting at dams. Pumping stations, filtration and chlorination facilities should be isolated with individual fences. In the case of industrial plants, fencing around the entire property is a prerequisite, with individual fences surrounding highly vulnerable spots such as power plants, transformer stations, chemical storage and fuel supply. And at one of the nation's most important aircraft plants a high chain link fence separating the administration building from the factory itself is employed as a special precaution.

Height and location

In selecting the proper fence several factors must be considered. First is the matter of height. This is largely dependent on local conditions, of course, but it would be manifestly unwise to use a 7-ft. fence when the necessity for a 10-ft. height of enclosure is clearly indicated. However, experience reveals that the 7 and 8-ft. heights, which include one foot of barbed wire, satisfy most requirements.

Proper location of the fence is another important consideration partly on account of the legal aspects. For instance, the barbed wire topping should not overhang the adjoining property because injury to another party under these conditions might lead to legal action. Therefore, if the protective fence has barbed wire on arms extending outward it is best to set the posts about one foot inside the property line. However, if the arms are set on the inside of the fence the posts may be placed on the property line. If no overhang is desired vertical arms may be used for barbed wire.

The accepted practice in setting posts calls for a distance of 10 ft. between centers. If the fence is installed on a wall or coping, holes must be drilled for the posts. If no wall is used, the posts are supported by drive anchors set diagonally in the ground at right angles to the fence line, or in concrete footings which are 36 in. deep and 10 in. in cross-section. When drive anchors are used the fence may be moved in cases where such action is made necessary by plant expansion.

Posts and metal fabric

To provide the elasticity or "spring" that enables a post to return to its original vertical position after being subjected to strain or shock, it should be made from high carbon

rail steel. This metal has excellent corrosion-resistant qualities which are further enhanced through galvanizing by the hot-dip spelter method. Open sections such as U-bar and I-beam are self-draining and are superior to pipe, on the inside of which moisture may gather to cause rusting and premature failure at the ground line.

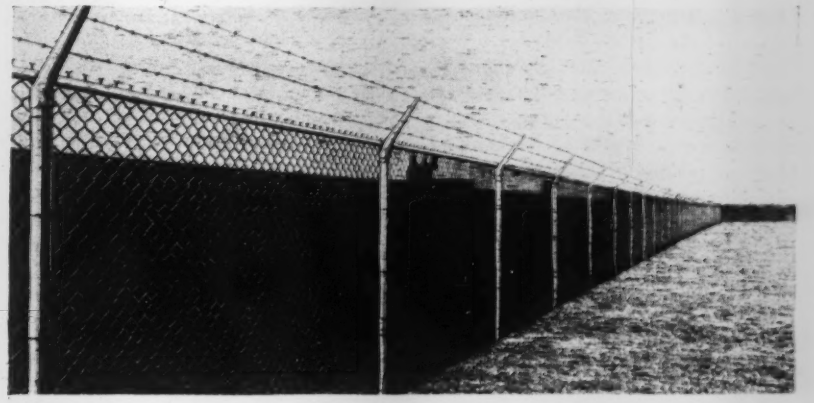
Chain link fabric is usually woven in 2-in. mesh from bright steel wire of either 6 or 9 W & M gauge. In order to insure utmost resistance to corrosion the wire should be hot-dip galvanized after weaving. Wire which has been zinc-plated by the electrolytic method is also obtainable. The latter has a smooth finish, and can be bent flat upon itself or wound around its own diameter without flaking or cracking.

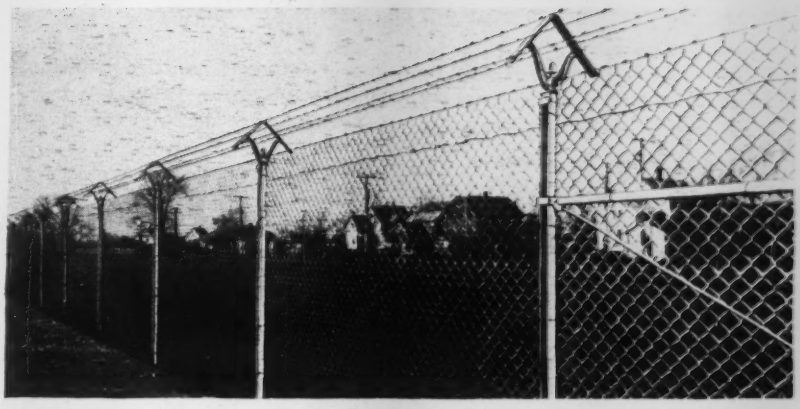
In all chain link fences the use of a top rail is optional. Some feel that its presence minimizes protection while admitting that it adds to the appearance in addition to simplifying the erection. However, if the fabric is set so that approximately two inches of the barbed edge of the selvage extends above the top rail it will eliminate the possibility of the rail being used as a hand hold. In cases where the fence line is lighted as an added precaution, a top rail should be used because it can be made to serve as a conduit for carrying the electric wires. Where this is done screwed couplings and waterproofed expansion joints are necessary.

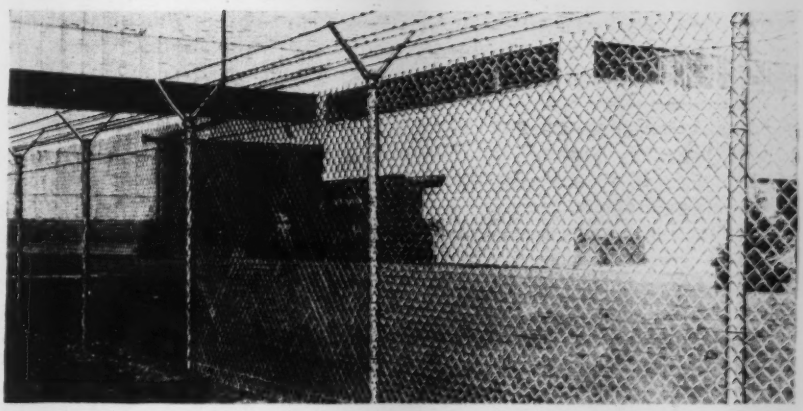
Barbed wire and gates

Practically all chain link fences used for protective purposes are equipped with barbed wire at the top and a wide choice of arm arrangement is available. As previously mentioned, a single arm may be attached to each post at an angle of approximately 45 deg. from the perpendicular or it may be vertical. In either case three strands of four-point barbed wire are fastened to the arms. The employment of an A-shaped arm permits the use of five strands of barbed wire with two on either side and one at the apex. Another type, and one which provides even greater protection, is the V-shaped arm which carries six strands of a barbed wire, three on each side. Regardless of the type arm employed the barbed wire can be charged with electricity if the wire is completely insulated from its carrying arms. A fence so equipped provides a formidable discouragement to poachers, trespassers and saboteurs alike.

The matter of gates must be given some thought. Naturally, they will be located at authorized entrance points and sizes will be governed by the purposes for which the gates are used so that pedestrian entrances and truck driveways will have openings of the proper size. In cases where the gate will be rarely used but must be available to care for emergencies it may be arranged so that it will lift off rather than swing. This type is







Among the standard practices in chain-link fence installations are the spacing of posts at 10-ft. intervals and the use of barbed wire at the top. In (1) the fence is on the property line and the barbed wire is mounted on a single arm which extends over the property; note the use of a top rail which can be employed to carry electric wiring for floodlights. In (2) is shown an A-type arm for carrying five strands of barbed wire. The V-type arm in (3) carries six strands of wire.

most often used in transformer enclosures. Swinging gates should be hung on hinges that will permit opening through an arc of 180 deg., and three strands of four-point barbed wire should be attached to all vertical members of the gate frame in all cases where the accompanying fence has barbed wire topping.

Gates other than the well-known swinging type are available for use in places where space is at a premium. Most generally used in such cases is the sliding gate; this may be suspended from overhead tracks by means of rollers attached to extended vertical members of the gate frame. A cantilever sliding type, which dispenses with the overhead framework, is also used.

When infrequent use of gate facilities or other reason makes it inadvisable to assign a full-time employee as gate-keeper, an electric operator which functions through remote control can be used. A gate thus equipped, whether swing or sliding, can be opened and closed from a distant point merely by pressing a button.

Because of the many variables involved, a manufacturer can give cost estimates only when he is supplied with a plot showing the lines to be fenced and all details concerning the proposed installation. However, the protection which a well-built chain link fence provides is a low-cost investment, particularly in times of unrest such as we are experiencing at the present.

Waterworks Practice When Cities Stop Growing

***Contents in Brief**—Census statistics indicate that before long we may expect a static population in this country. This is of special significance to engineers who design and operate utility services. What it means to waterworks men was explored by Reeves Newson, consulting engineer in the following comments before a recent meeting of the New Jersey section of the American Water Works Association.*

WHAT ARE SOME OF THE THINGS we may expect if the growth of most cities and our population has substantially ceased?

First, waterworks men are going to have more time to think about the efficiency, economy and effectiveness of their operating and maintenance methods. In many water plants primary interest has been directed toward keeping up with growing demands for service in new territories. That work has been the gage of activity and the factor which determined the size of the organization. Every operator is confronted with a dozen or more things having to do with more efficient operation, better maintenance, completion of records or the department's public relations, all of which he has been hoping to get around to for years; but problems resulting from the growth of population required first attention.

Demands arising from the present defense activities will, in many places, postpone the effects of a static population condition, but we are here discussing the matter as it will influence waterworks activity in the next decade. Improvement in all phases of quality of service as distinct from quantity of production will be one result of growth cessation.

We are going to find that nearly all our facilities are going to last longer. Sources of supply that have seemed to be nearing their safe limits are going to be adequate for a surprising number of additional years. Transmission lines and main distribution feeders will not have to be reinforced as soon as anticipated, and purification and pumping plants will continue to serve without the enlargements which were expected. To be sure, the modernizing of these types of equipment to furnish properly conditioned water and to produce required pressures with smaller power bills may be expected to proceed more rapidly because those were among the things that had to wait while growth demands were met. But modern plants, where only size is in question, will not have to be changed for a while, and development of a plant to its ultimate size will not have to be taken as soon as expected.

Many of the elements of a water plant are fundamentally long-lived. In the past much of such physical life could not be realized because changes from rapid population growth made it necessary to replace many facilities which were inadequate although substantially as capable of doing the job they were designed for as the day they were put in. Also it is true that as experience has accumulated, materials and equipment have been better made, mechanical facilities are nearer the highest practical efficiencies attainable, alloys of metals more resistant to destruction have been made available and methods of preventing corrosion and other forms of deterioration have been put in practice.

All these factors help to prolong the life of waterworks equipment but in spite of them changes caused by rapid growth and population movement would have necessitated considerable in the way of replacements. This means that less depreciation will occur in water plants in the future. That, in turn, would mean that the term of municipal waterworks bonds justifiably could be lengthened or that provisions for depreciation can be made less of a burden to the rate payer.

With more time to devote to the problem of operation, the percentage of accounted-for water should generally rise. This is a function of the frequency and thoroughness of underground wastage elimination work and the quality and frequency of meter repairs, both of which have to suffer when construction of new facilities is foremost in the minds of a department's personnel.

Summarizing these thoughts, I expect that as a result of the population trends shown in recent years, the waterworks man is approaching a period when he will get a chance to do the hundred-and-one things concerned with operation which heretofore he couldn't get around to. As a result, service should become better, with concurrent reduction of cost. At the same time it will be found that cessation of growth in population allied with progress in improving the resistance of materials and the efficiencies of mechanical facilities, will result in nearly all elements of a waterworks system—from the source of supply to the machines for making the bills—giving more adequate and effective service.

What To Do About Fly Ash

Henry W. Taylor
Consulting Engineer, New York

***Contents in Brief**—If your municipal incinerator shoots out fly ash (which it shouldn't) there are three probable reasons—inadequate capacity, inadequate design or improper operation. This article discusses the causes and suggests some practcal remedies for fly ash troubles.*

ESCAPE OF FLY ASH, smoke or odor from municipal incinerator chimneys is a matter of both engineering and legal importance. From the engineering standpoint, ways and means are now included in modern design to prevent any such condition, and such instances as may now occur represent a remnant from past construction, rather than a matter of liability in modern installations. However, nuisance prevention is a matter that demands careful consideration in new designs, and in isolated cases of older designs it presents an operating problem.

Several cases of air pollution nuisance have been carried to Supreme Courts and it has been ruled that no business, however lawful or modern, may be carried on so as to interfere with comfortable enjoyment of adjoining residential property. A valuable digest of legal findings recently was published by L. R. Bloomenthal in the February, 1940, issue of *Heating, Piping and Air Conditioning* magazine. Here, among other things, we learn it has been held that even when a locality is predominantly industrial, owners of residences are entitled to freedom from noises and odors which affect their health. The fact that the complainant voluntarily moved into such a district, after the industrial plants had been established does not apparently deprive him of his right to complain. On the other hand, some authorities have maintained that the zoning of a section for industrial purposes imposes a duty on neighborhood owners to submit to certain inconveniences which might be actionable nuisances in other sections, but also maintain that all reasonable precautions must be employed to prevent excessive noises, smoke or fumes.

Steam from the incinerator building and superheated water vapor from chimneys are often confused with fly ash emission.

In those states which have upheld the right to complain of nuisances in industrial districts, this privilege is not unlimited, reports Mr. Bloomenthal. No matter how irritating or disagreeable the situation, there must be proved a hazard to health or to the value and enjoyment of adjacent property. In the general case, courts of equity have refused to anticipate that a new structure will become a nuisance, denying injunctions unless it can be shown that the proposed business cannot be operated without nuisance.

In usual parlance relating to municipal incinerators, "fly ash" includes small pieces of unburned paper and minute particles which have not been intercepted in chambers designed for that purpose. In general, there are three basic causes for a fly ash condition: (1) inadequate initial capacity; (2) inadequate design; and (3) improper operation.

Forcing of furnaces beyond their rated capacity vitiates all the elements of design, as well as surcharges chambers, flues and catchment areas; such practice generally involves excess use of forced draft facilities, and this increases gas velocities and promotes short-circuiting of gas flow. Difficulties which result from poor design are hard to overcome, but they can be partly compensated by careful operation adapted to the weaknesses of that design. Poor operation will vitiate a good design and can aggravate a poor design; this trouble may be traced to lack of training and interest on the part of the personnel and to interference for political reasons.

It is well established that fine material in flue gases cannot be dropped out through gravity action alone, except with a flue gas velocity so low as to make gravity action impracticable. The dropping of this fine material must be accomplished by centrifugal action at turns, by bumping against walls, by deflection of flow and retardation, by interference between two volumes of gas flow, and by pockets to intercept the material whisked along the bottom of flues and chambers. Care must also be taken to arrange intercepting areas so that after deposits have accumulated, they will not be disturbed by sudden changes in the flow of gas.

Short-circuiting of flue gas will reduce the time of flow and thus detract from the usefulness of proposed turns and turbulences which the gas flow was designed to follow. These conditions can sometimes be rectified by "checker walls," loose firebrick walls with openings (which produce a resistance to straight-through flow), or by the judicious use of baffle

walls. The addition of baffles in an existing installation should be studied carefully before any assumptions are made as to their most effective location; such studies can be made by temporary installation of dry brick walls in various places and noting their effect. If the factors of gas velocities, short-circuiting of gas flow, turbulence and interception are not recognized in both design and operation, a fly ash condition may result. In some cases—especially if forced draft is being used—cutting off the air supply during the charging operation will help matters. Visits to incinerators indicates that forced draft is being considered as a reserve and not as a constant adjunct to plant operation, and both draft and excess air use are being carefully controlled.

Fine material trapped

It must be remembered, too, that fine material will become attached to hot slag on walls if the gas flow is directed toward these walls and deflected along them, thereby intercepting fine material which would otherwise escape to the chimney. The roll of the gas produces a centrifugal action, forcing the material in suspension to the outside, namely, along the face of the wall, and the fine matter is caught by the rough and hot slag surfaces and entrained there. This accumulation on walls and floors, representing a mat of enmeshed fine material, which later can be removed in chunks or slags.

Areas of adequate capacity must be provided for the interception and storage of material which has once dropped out of the flue gases. This storage should be safely out of the way of gas flow or scrubbing action of this flow. Quick changes in velocity and opportunity for swirls, rolls, interference and retardation will contribute to the deposits of fine material.

Remedial measures

In the general case, it is important first to investigate the validity of a complaint. Many cases are known where an incinerator is installed in an industrial area, which for years has been subjected to heavy smoke and much fine material and soot in flue gases. No complaint is made, however, until a municipal utility is placed in operation and then all complaints are often erroneously directed toward the new plant whose owner is a municipality and thus more vulnerable to complaint and suit.

In a discussion of remedies for a condition which may be due to many different factors, it should be understood that the writer cannot be expected to offer a specific remedy for all conditions. The diagnosis for a fly ash condition requires a careful review of the design, an appraisal of the material being burned and a study of the methods of operation. However, in discussing the matter with engineers, operators and constructors, there seem to be certain established expedients for amelioration of trouble. These outside opinions are acknowledged herewith, together with the radical differences of opinion which exist as to the best method of approach.

In a case of unburned pieces of paper, screens have been used either at the top of the chimney or at the head of the main breeching. The chimney screen is cylindrical, about 3 ft. long and equipped with a top screen to inclose it and to hold pieces of paper until they are consumed. It is claimed that these screens do not clog appreciably, and that they effectively serve to detain material and hold it for complete combustion. The screen used at the head of the breeching is generally of one-half inch mesh and is made either of special alloy or of steel, the latter requiring frequent replacement. These expedients are applicable only to the larger suspended material in the flue gases and the writer is inclined to agree with those who consider that the screen is not the best solution to the problem.

Use of steam

Where steam is available, as in the case of incinerators with water-cooled grates, it has been utilized in jets across the gas flow; it is claimed that this will promote deposition of ash in the chimney base pocket. This is a crude method of smoke washing, which if fully developed would be both expensive in installation and operation. It is reported, however, that the use of steam has proved effective in some cases.

In some cases where fly ash troubles developed, the problem was quickly solved by the constructor through trial-and-error studies of baffling; after the proper arrangement was experimentally determined permanent baffle walls were installed. Short circuits and baffles have already been discussed under another heading as one of the most significant remedial measures.

Operation methods should be carefully scrutinized when fly ash troubles are encountered. Overcharging, excess air supply, unwarranted and continuous use of forced draft (both in pressure and amount), cleaning of fires, stoking, lack of training, lack of adaptation of methods to design, attempted economy where an overworked capacity should be granted a two-shift operating period—these are among the factors which can be cited as contributing to fly ash.

A gas flow condition can often be changed by adjustment of the amount and pressure of forced draft. The writer has experimentally determined these possibilities in operating plants. With the proper amount of air and air pressure, the desired rolls and deflections in easy curves which result in the deposition of suspended material can be obtained. A change in air and pressure can convert the desired condition into a rush of gas flow on an all-out basis, short-circuiting intended travel and vitiating the design. Peepholes should be provided in all chambers so that the gas flow can be observed by the operator, these holes being of ample size for thick walls so that the range of vision includes more than a general glow of heat and flame. With forced draft, the point where the positive pressure of the fan becomes neutral and the negative pressure of draft from the chimney comes into play is well worth observation and control.

Supervise new installations

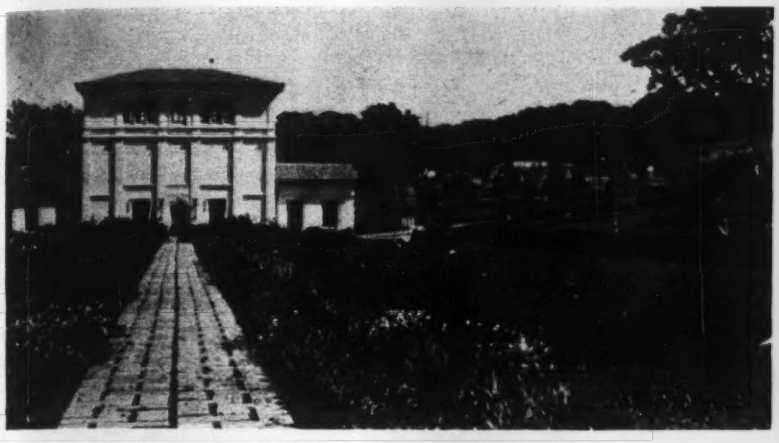
The operation of a new incinerator should always be supervised for at least three months by a competent authority so that operators may be trained and precautions adopted to meet special conditions. An incinerator is not an enclosed bonfire and it requires responsible control in operation as well as in design. This control requires facilities for observation, suitable instruments and an intelligent interpretation of the observations made. In conclusion, the writer is of the opinion that a fly ash condition can be rectified by sound adaptations in the design, in the methods of operation, or both, and that a properly designed and operated incinerator will cause no trouble.

From Field and Office

Working problems and time-saving methods for engineers and contractors

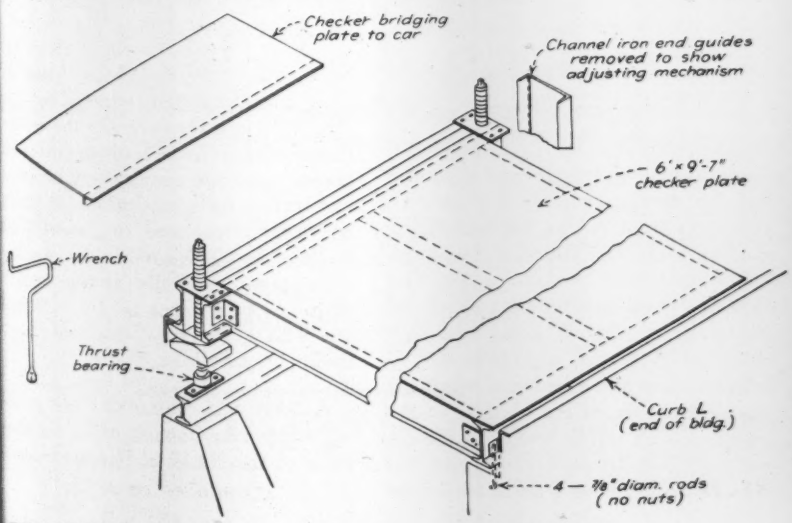
Treatment Plant Beautification

At the Orinda treatment plant of the East Bay Municipal Utility District, Oakland, Calif., not only are the grounds beautifully landscaped, but gardeners are employed permanently in keeping them in attractive form. Flowers of some kind are in bloom all year round and an encircling drive brings people of the community frequently to the plant to admire the floral display which surpasses those in many city parks.



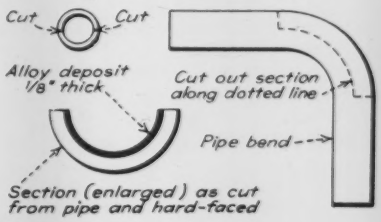
Adjustable Loading Platform

The loading platform shown by the accompanying sketch has been put in use by the writer's company for loading cars by means of electric trucks. As may be seen, the platform is adjustable to different car-floor heights thus giving an even incline from the warehouse door to the car floor, which is advantageous to electric-truck operation, particularly under snowy and icy conditions. In the case illustrated the distance from the warehouse door to the car is about 11 ft.; at another place a similar but shorter platform is used for loading motor trucks. The platform construction and operating mechanism are clearly indicated by the drawing. These platforms have paid for themselves in time saved and reduced wear on electric trucks.—R. J. THOMPSON, *plant engineer, National Malleable & Steel Casting Co., Cleveland, Ohio.*


Checker bridging plate to car
Channel iron end guides removed to show adjusting mechanism
6'x9'-7" checker plate
Wrench
Thrust bearing
Curb L (end of bldg.)
4 — 7/8" diam. rods (no nuts)

Hard Facing Pipe Bends

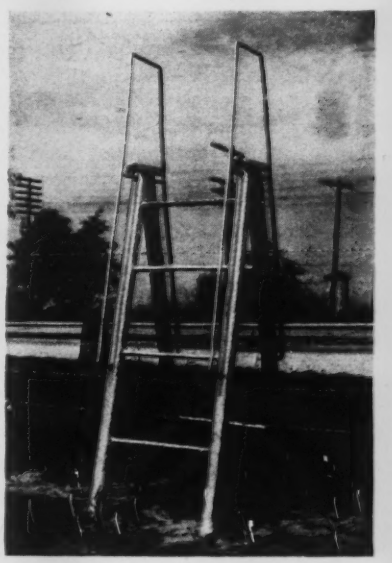
To increase the life of bends in pipelines that carry abrasive materials the inside of the bends can be strengthened by the method indicated by the accompanying sketch. As



shown half the diameter of the pipe on the outside of the bend is cut out by torches for the full length of the bend between tangents. The piece of pipe that is cut out is then coated with a $\frac{1}{8}$-in. hard alloy welded to the inside. The hard-surfaced length of pipe is then inserted in the cut and welded in place to restore the bend. This information is from *Oxy-Acetylene Tips*, published by the Linde Air Products Co., New York, N. Y.

Safety Stile

Made up from scrap pipe and short lengths of rod, with a hand rail and caps over the tops of the twin side members, a utility company provides a safe and attractive stile for its employes to cross wire fences maintained around facilities in unguarded locations. The steel stile is fireproof and will withstand a brush or grass fire, which would quickly destroy the usual wooden structure.—ELTON STERRETT, *Houston, Tex.*



Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Concrete Manual

CONCRETE MANUAL—Third Edition. 466 pp. Published by the United States Bureau of Reclamation, Denver and Washington. Price $1. (Make checks payable to Treasurer of the United States).

Since its first appearance in 1938, the "Concrete Manual" of the Bureau of Reclamation has assumed an important place in many engineers' libraries. Compiled by the engineers of an organization that uses tremendous amounts of concrete and who have available both laboratory and field study facilities that are second to none, it is not surprising that the manual is accorded wide attention. The third edition, dated January, 1941, and just published, brings concrete knowledge up to date and outlines bureau practices in specifying cement, selecting and testing aggregates, in mixing on jobs of different sizes, in field inspection and testing, and in proportioning, placing and curing. A final chapter is devoted to special types of concrete.

Elementary Structures

ELEMENTARY STRUCTURAL ENGINEERING—By Leonard C. Urquhart and Charles E. O'Rourke. 348 pp. Published by McGraw-Hill Book Co., New York and London. Price $3.

STRESS ANALYSIS AND DESIGN OF ELEMENTARY STRUCTURES—By James H. Cissel. 335 pp. Published by John Wiley & Sons, New York; Chapman & Hall, London. Price $4.

Textbooks on the fundamental principles of structural theory and design are beginning to follow a slightly different pattern from some of the older ones if these two may be taken as an example. The difference is that they are planned for the non-structural specialist who has neither the time nor the need to acquire more than a bare working knowledge of design fundamentals. They therefore present only so much of abstract theory as is necessary, and take the student into practical design problems as rapidly as possible.

Professors Urquhart and O'Rourke in "Elementary Structural Engineering" had definitely in mind the needs of graduate engineers and architects for a compact guide book that would aid them in preparing for professional license examinations. Four chapters present what might be called basic information—principles of mechanics, properties of materials, types of loads and methods of computing deflections of beams and trusses. The remaining chapters explain and apply these theories to the design of the various structural elements. Steel, timber and reinforced concrete construction are covered. The book is also planned as a text for courses in structures given to engineer students other than civil and to architects.

Professor Cissel's book on "Stress Analysis and Design of Elementary Structures" is also planned for students taking other than a civil engineering course. Contents emphasize the fundamental and practical material that would generally be of value to an engineer in any field. The book is divided into two parts, stress analysis and design of simple structures. Basic data cover loads, graphic analysis, reactions, shears and bending moments as well as restrained and continuous beams and chapters on trusses and stability of masonry structures and foundations. The design section covers beams and columns of timber, steel and reinforced concrete.

Planning Public Works

DEVELOPMENT OF RESOURCES and Stabilization of Employment in the United States—Part 1: A Federal Program for National Development; Part 2: Regional Development Plans. Published by the National Resources Planning Board and available from the Superintendent of Documents, Washington, D. C. Part 1, 25c.; Part 2, 80c.

As a step in long range planning for the development of the nation's resources as a means for stabilizing employment, the National Resources Planning Board has issued the first two parts of a three-part work on that subject. Part 1 deals with federal public works and federally financed state and municipal work. It consists chiefly of an analysis of the effect of such public works in the decade 1930–1940, with some information as to budgeted federal works for the fiscal year 1942 and a very brief summary of projected expenditures under a six-year plan for the period following 1942. Part 2 is made up of separate statements of regional development plans for the ten regions into which the National Resources Planning Board has divided the country. These are chiefly the oft-repeated generalities as to what should be covered in broad plans for regional development; there are few specific recommendations that could be made into a program of work to be undertaken as the defense effort declines.

Part 1 points to the need for a "reservoir" of public construction projects that can be put into a six-year program, also to the need for immediate inauguration of surveys, preparation of plans and specifications for selected projects, the advance authorization by Congress of procedures for grants, loans and aids to state and local governments for non-federal projects, appropriations for advance purchase of sites and the development of methods for financing local public works. Here again, however, specific recommendations are lacking.

Miscellaneous Notes on Booklets and Reprints

A PLAN OF MOTORWAYS for Detroit has been issued by the Michigan State Highway Department in the form of a colorful brochure that is worthy of attention by other highway departments interested in getting public attention to their reports. It brings up to date the work done in the 1925 master plan for Detroit, laying down the locations for "expressways," "surfaceways," and a large parkway loop encircling the city. The expressways are the major routes. They have limited points of access, separate roadways for opposing traffic, no intersections at grade and may be elevated, depressed or at the surface. The surfaceways are the next stage, generally at the surface with more frequent points of access but with grade separations at major traffic intersections.

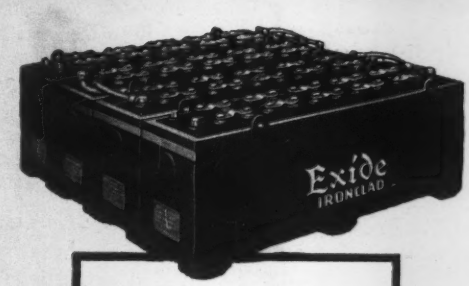
A NATIONAL BUILDING CODE is being written in Canada under the auspices of the National Research Coun-

(*Continued on p. 77*)

When industry calls for more materials...

Exide-Ironclads help the mines and quarries *DELIVER!*

America's great industrial plants not only produce... they *consume.* The demand for raw materials has leapt skyward. The nation looks to its mines and quarries to feed its hungry industry. In this the unfailing dependability of Exide-Ironclad Batteries is proving itself invaluable. By speeding up underground haulage, Exide-Ironclads are helping to speed America's defense.



More Exide-Ironclads are used underground than all other batteries combined. This is no mere accident, for these batteries give locomotives and trammers the extra power, extra speed, and the dependable day in, day out performance that produce greater tonnage in less time.

You can rely on Exide-Ironclads to speed up your haulage service and to guard against bottlenecks underground. Write for free booklet, "The Storage Battery Locomotive for Underground Haulage."

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THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
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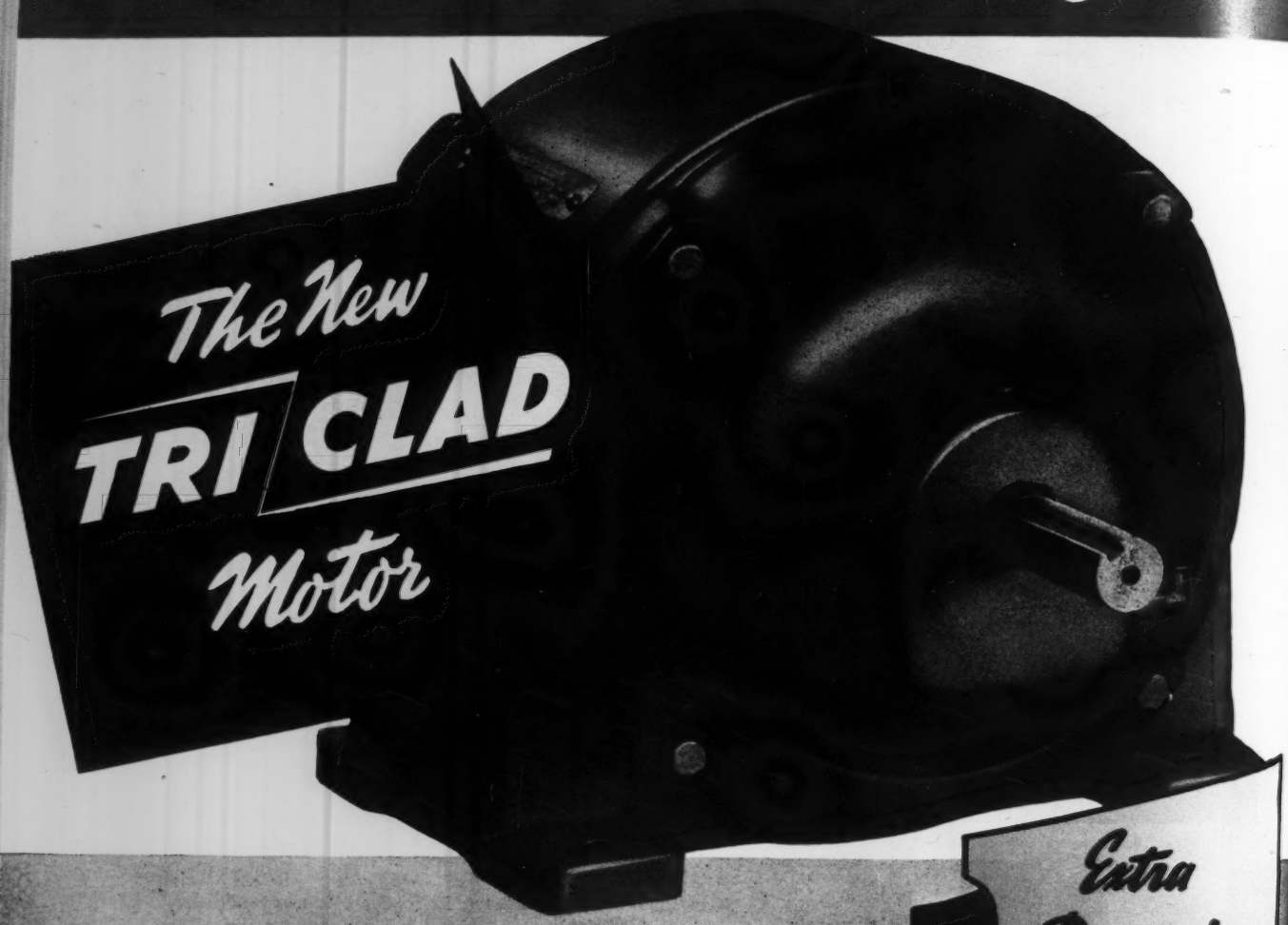
Inner Strength

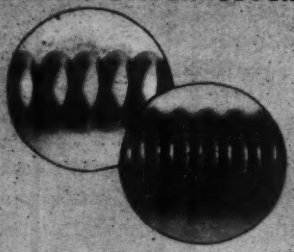


* New FORMEX WIRE maintains

ITS DIELECTRIC FILM UNDER SEVERE CONDITIONS

ABRASION

Formex wire is insulated with a vinylacetal-type plastic developed by G-E engineers after 10 years of research. Tests of resistance to abrasion show a 3-to-1 superiority of Formex wire over high-grade enameled wire. Formex wire in *your* motors gives added assurance of dependable, continuous operation.

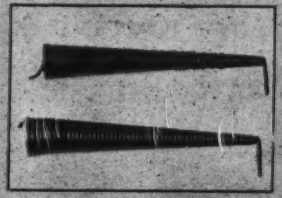


ELONGATION

Compare the two pictures above. The top photo shows Formex wire stretched 20 per cent and wound on its own diameter. The lower picture shows enameled wire stretched 10 per cent and wound on twice its diameter.

HEAT SHOCK

The top sample (below) shows what happens to good enameled wire when it is wound in a helix and heated to 150 C. Formex wire (shown at bottom) is unaffected by this heat shock. That is why it does not become brittle and crack away even after years of strenuous service.



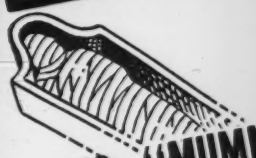
1 Extra Protection

against physical damage

Strong, one-piece, cast-iron frame and end shields, with upper portion completely enclosed, protect vital motor parts from external blows, flying chips, settling dust, dripping liquids.

...built for protection first ...to last!

h Begins WITH FORMEX*



NO "MUMMY INSULATION" HERE

With Formex wire, G-E engineers were able to "take off the wraps" on random-wound motors. Away went organic "mummy" coverings and heat-enclosing compounds. Having Formex wire, G-E engineers built a stronger, tougher motor insulation.

Extra Protection

against electrical breakdown

When you're looking for a longer-lasting motor—one that won't wilt and weaken after years of strenuous service, or fail you in an emergency—you want the Tri-Clad motor with its *inner strength.*

When G-E engineers designed the Tri-Clad motor, they saw that the toughness of Formex wire insulation opened up new opportunities for strengthening the entire coil assembly from the inside out. They utilized new G-E synthetic-resin bonding varnishes to give rigidity and extra resistance. They fortified the slot-cells. They welded internal connections.

Finally, they selected for application on end turns a coating of Glyptal No. 1201 Red as an additional armor against the many adverse operating conditions commonly found in industrial service.

Thus, in the Tri-Clad motor you get a more compact winding—one that dissipates heat quickly and keeps the motor young.

With double-end, "controlled-velocity" ventilation and advanced electrical design throughout, the Tri-Clad motor's tougher coil windings mean extra years of service. Next time you order induction motors . . . . make sure they are Tri-Clad motors. General Electric, Schenectady, N. Y.

Integral-hp sizes up to 20 hp (at 3600 rpm), open or splashproof, are now available—also capacitor-motors in sizes up to 5 hp.

Write for our new Tri-Clad motor bulletin, GEA-3580

Extra Protection

against operating wear and tear

Sleeve bearings of new design have longer life, greater capacity, improved lubrication features. One-piece cast-aluminum rotor winding, with fans cast integrally, is practically indestructible. Sealed ball bearings retain lubrication, exclude dirt.

GENERAL ELECTRIC

750-50-8052

To Earthmovers Considering Hi-Speed Self-Propelled Scraper Rigs

Choose Machines That Have Proved Profitable

TOURNAPULLS

When you put Tournapulls on your job, you get high-speed, self-propelled rigs designed from the ground up for profitable scraper loading and hauling over construction roads. You get weight where it's needed—on the drive wheels—to give you traction for pulling big yardages through tough going. You get plenty of power and the proper gear ratios with this traction to give you the *quick acceleration* so necessary for *high average speed*. You use the same big-yardage Carryall Scrapers and sure-acting LeTourneau Power Control Units that have proved such big money-makers with tractors. You save on equipment costs, too, because Tournapulls haul and spread their own loads, do a partial job of compacting, require only a pusher for loading.

WORKING IN 30 STATES

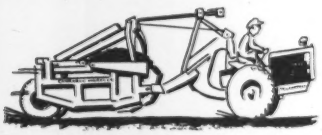
Today Tournapulls are in daily use in 30 states and several countries abroad, extending Carryall savings to long hauls beyond tractor-scraper range. Like scores of other successful contractors you can increase your profits with Tournapulls. See your LeTourneau-"Caterpillar" dealer . . . get your order in NOW to assure early delivery.

One of 4 Standard C Tournapulls (powered by "Caterpillar" D468 engines) and LS Carryalls (1[illegible] heaped yards) rushing H. E. Wolfe's big airport job at Chamblee, Ga. Other LeTourneau equipment on the project includes 8 Carryalls, 3 'Dozers, 2 Sheep's Foot Rollers and 2 Rooters.

BUILT FOR EASY OPERATION

Just as tiller wheels long ago were discarded as useless on track-type tractors, so LeTourneau eliminated front steering wheels on Tournapulls.

Result: Tournapulls have no front wheels to bog down when traveling or turning in mud or sand . . . can turn faster and sharper than any other self-propelled scraper-hauling rig . . . have a long, easy-riding wheelbase. All operating controls are



within easy reach of the operator's airfoam bucket seat. Big brakes on both Tournapull and Scraper assure quick stopping and complete control on grades.

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PEORIA, ILLINOIS • STOCKTON, CALIFORNIA

For Lowest Net Cost per Yard - CARRYALL* SCRAPERS, ANGLEDOZERS*, BULLDOZERS, ROOTERS*, DRAG SCRAPERS, POWER CONTROL UNITS, CRANES, PUSHDOZERS, SHEEP'S FOOT ROLLERS, TOURNAPULLS* TOURNATRAILERS*, TOURNACRANE.

*Name Reg. U. S. Pat. Off.

Miscellaneous Notes on Booklets and Reprints

(*Continued from p. 72*)

cil. It is designed to be a model for municipalities in revising their codes. Part 3, Engineering Requirements, has just been issued and can be obtained from the National Research Council, Ottawa, Ont., price $1.75. Part 5, Requirements Bearing on Health and Sanitation, was issued some time ago. This sells for 50c. Other parts will be issued as they are completed.

TO AID HIGHWAY MEN in their campaign against increased highway taxes and diversion of highway tax money, the National Highway Users Conference has issued in mimeographed form under the title of "The Farmer's Taxes, New and Old" extracts from a tax survey that it has been conducting. The purpose of this pamphlet is to make farmers, one of the largest low-income groups in the country, conscious of the fact that he is paying an inordinate share of his income in taxes on gasoline and motor vehicles.

DEVELOPMENTS IN THE POWER FIELD during 1940 are covered in three well illustrated brochures issued by major industries serving that field: "Electrical Developments of 1940," General Electric Co., Schenectady, N. Y.; "Engineering Progress, 1940," Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; "Annual Review, 1940," Allis-Chalmers Mfg. Co., Milwaukee.

New Engineering Books

THE STEREOGRAPHIC PROJECTION—By F. W. Sohon. 210 pp. Published by the Chemical Publishing Co., Inc., Brooklyn, N. Y. Price $4.

GENERAL ACCOUNTING—By H. A. Finney. 604 pp. Published by Prentice-Hall, Inc., New York. Price $5.35.

HEATING VENTILATING AIRCONDITIONING GUIDE 1941—Vol. 19. Published by the American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York. Price $5; with thumb index $5.00.

FARES, PLEASE! FROM HORSECARS TO STREAMLINERS—By John A. Miller. 204 pp. Published by D. Appleton-Century Co., New York and London. Price $3.50.

FLUID MECHANICS—By Glen N. Cox and F. J. Germano. 274 pp. Published by D. Van Nostrand Co., Co., Inc., 250 Fourth Ave., New York. Price $3.

ANNUAL REPORT OF THE CHIEF OF ENGINEERS U. S. ARMY—Part I, Vol. 1, and 2. For sale by the Superintendent of Documents, Washington, D. C. Price $1.50 each.

LABOR AND NATIONAL DEFENSE—A Survey of the Special Labor Problems Arising from America's Defense Activities and a Program for Action. The factual findings by Lloyd G. Reynolds. The program by The Labor Committee. 143 pp. Published by The Twentieth Century Fund, 330 West 42nd St., New York. Price $1.

LOS ANGELES: PREFACE TO A MASTER PLAN—Prepared by The Pacific Southwest Academy. 330 pp, charts, maps and tables. Printed by Ward Ritchie Press, 1936 Hyperion Ave., Los Angeles, Calif. Price $3.

DRAINAGE AND FLOOD-CONTROL ENGINEERING—By George W. Pickels. Second Edition. 476 pp. Published by McGraw-Hill Book Co., Inc., New York and London. Price $4.

HYDRAULIC MEASUREMENTS—By Herbert Addison, Fuad I. University, Giza, Egypt. 301 pp. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York. Price $5.

THEORY OF SIMPLE STRUCTURES—By Thomas Clark Shedd and Jamison Vawter. Second Edition. 505 pp. Published by John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London. Price $3.75.

STRUCTURAL DRAFTING—By Carlton T. Bishop. 287 pp. Published by John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London. Price $3.50.

STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES—Third Edition. 248 pp. Published by The American Association of State Highway Officials, National Press Bldg., Washington, D. C. Price $2.

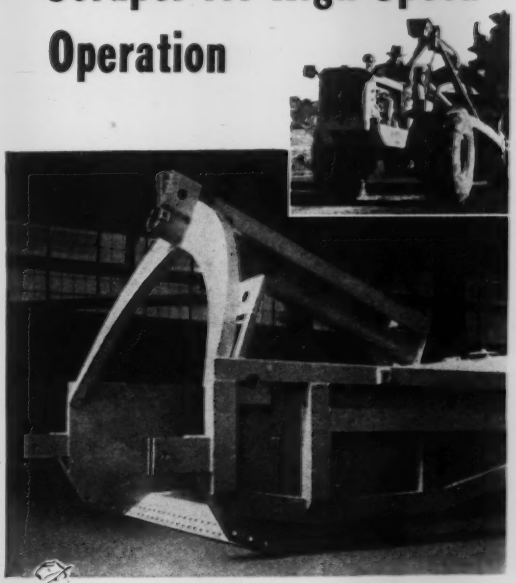
Reports and Pamphlet

HARTFORD, CONN.—Eighth Biennial Report of the State Water Commission, 1938–1940.

BIRMINGHAM, ENGLAND—Twenty-

(*Continued on p. 78*)

HOW to Select a Scraper for High-Speed Operation



GET ONE THAT'S BUILT TO TAKE THE STRAINS AND SHOCKS OF ROUGH WORK . . . A LeTOURNEAU CARRYALL

A LeTourneau Carryall Scraper body can't warp. It's built like a box, reinforced at every corner, side, top and bottom to prevent twisting and distortion. Bottoms are built of double plate steel with inner channels. Side plates are strengthened with welded channel steel. Front sides are strongly tied together by a high arched frame of steel and a heavy blade base. Rear end of body is made rigid by a heavy box-beam of welded construction. And then, front and rear are joined by the stout springpipe. No other scraper gives you the strength of this Carryall body. More than 8000 in use with tractors. Now, thousands of hours of Tournapull operation . . . the country over, in mud, sand and heavy going . . . demonstrate that LeTourneau Carryalls can keep your job moving profitably despite the increased shocks and strains of high-speed work. For profits on long hauls use fast-moving Tournapulls with stoutly-built, cable controlled Carryalls. See your LeTourneau-"Caterpillar" dealer NOW.

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Please send me your illustrated booklet "How to Select a Self-Propelled, High-Speed Earthmoving Unit."

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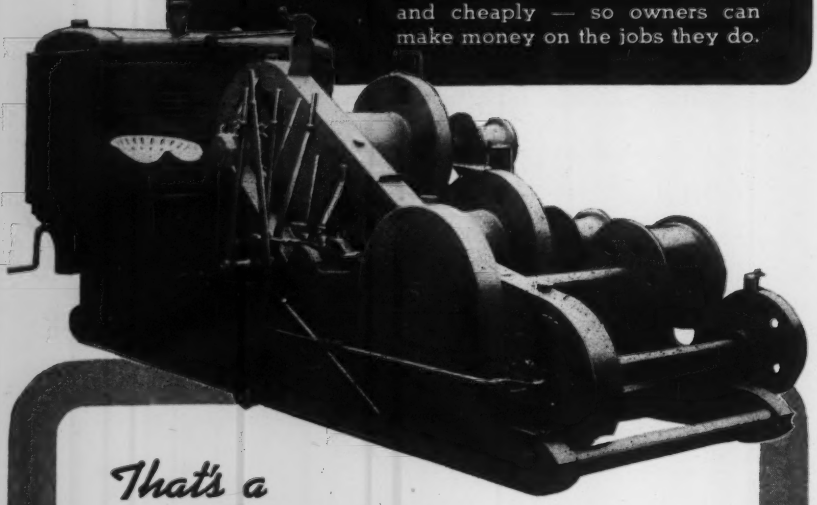
A Quality Hoist AT A PRICE

Built to move materials swiftly and cheaply — so owners can make money on the jobs they do.



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Five models — covering a hoisting range of one to five tons.

Any one drum model can be expanded in the field by adding additional drums.

Simple, efficient design and rugged construction insure high class, long-time service without delays or expensive repairs.

Your choice of Gasoline, Diesel or Electric power.

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AMERICAN TERRY DERRICK CO. . . . SOUTH KEARNY, N. J.

write for **CATALOG 100-H-1A.**

(*Continued from p. 77*)

sixth Annual Report of the Birmingham Tame and Rea District Drainage Board.

OKLAHOMA—Biennial Report of the State Highway Commission, 1940.

LARCHMONT, N. Y.—Annual Report, 1940.

MISSOURI—Twelfth Biennial Report of the State Highway Commission, 1940.

FEDERAL WORKS AGENCY—First Annual Report, 1940. For sale by the Superintendent of Documents, Washington, D. C. Price 55c.

HONOLULU, HAWAII—Eighth Biennial Report of the Board of Water Supply, 1939–40.

LYNCHBURG, VA.—Annual Report, 1940. ST. LOUIS, MO.—Twenty-third Annual Report of the City Plan Commission, 1940.

POLLUTION ABATEMENT IN NEW YORK HARBOR—By Ralph H. Mann. Published by the Service Bureau, American Wood-Preservers' Association, Chicago, Ill.

TEXAS—Proceedings of the Fourth Texas Conference on Soil Mechanics and Foundation Engineering. Parts I and II (separate volumes). Published by the University of Texas, College of Engineering Research, Austin, Texas. Part I contains three papers on pile foundations and pile driving.

SIX-YEAR CAPITAL IMPROVEMENT PROGRAM FOR MARYLAND—Maryland State Planning Commission Publication No. 30. For sale by the Maryland State Planning Commission, Latrobe Hall, The John Hopkins University, Baltimore, Md. Price 25c.

BENDING TESTS ON PANELS OF STIFFENED FLAT SHEET—Technical Paper No. 4. Published by the Aluminum Company of America, Pittsburgh, Pa.

STATIC AND REPEATED LOAD TESTS OF ALUMINUM ALLOY AND STEEL RIVETED HULL PLATE SPLICES—Technical Paper No. 5. Published by the Aluminum Company of America, Pittsburgh, Pa.

PAPERS Presented at the Highway Conference Held at the University of Colorado January 9 and 10. University of Colorado, Boulder, Colo.

BETTER BASES FOR BETTER ROADS—The Use of Calcium Chloride Stabilized Graded Aggregate Mixtures. Solvay Sales Corp., 40 Rector St., New York.

FEDERAL AIDS TO LOCAL PLANNING—National Resources Planning Board. 150 pp. Superintendent of Documents, Washington, D. C. Price 10c.

MEN AND JOBS

J. A. BAIRD, consulting engineer and surveyor of Sarnia, Ont., has been named executive engineer of Union Gas Co. of Canada, Ltd.

CAPT. R. S. NELLE, assistant engineer in the sewerage section of the Illinois state division of sanitary engineering at Springfield, has been called to military service with the Engineering Corps at Fort Lewis, Wash., where he reported April 20. CAPT. HAROLD SPAEDER has left the division for service with the coast artillery at Fort Monroe, Va. He was a district state sanitary engineer at Pana, Ill.

L. L. STOCKTON of Norman, Okla., has been appointed as engineer for the Columbia Construction Co. on the Los Angeles, Calif., breakwater job. He has recently been employed on the construction of the naval air station at Corpus Christi, Tex., with the Brown-Bellows-Columbia Co.

HARLAN HUTCHINS, who has been with the Tri-County hydroelectric project in Nebraska as an engineer for about three years, has taken a position in the special engineering department on the third set of locks for the Panama Canal, with headquarters at Cristobal, C.Z.

D. L. CHENEY, associated with the Montana highway department for the past 14 years, has resigned to accept a position as construction engineer with the S. Birch & Sons Construction Co. of Great Falls, Mont.

B. D. KEATTS, of Milwaukee, housing consultant of the Portland Cement Association since 1938, has resigned and will go to Chicago to become engineer for the Dur-Ite Corp., a concrete construction engineering firm.

The following recent changes in the Mississippi WPA engineering staff have been announced by acting director M. H. Tobias: C. E. BURRELL, state planning engineer has been transferred to the regional staff in New Orleans, La., and will be succeeded by C. C. COMPTON, estimater in the state office. W. H. BOUTWELL, former area engineer at Hattiesburg, has resigned to accept the position as county engineer for Jones County; D. F. SIMMONS, a former field superintendent, will succeed Mr. Boutwell. A. J. SPRADLIN, field engineer in charge of building, has gone with the Portland Cement Association in Louisiana. L. L. CAMPBELL, formerly with the state highway department at Jackson, has become WPA field engineer, principally on national defense projects.

The following transfers are effective in the Civil Engineering Corps of the U. S. Naval Reserve:

LT. JACK GORDON DODD, Ritzville, Wash., has been ordered to active duty in the Bureau of Yards and Docks, Navy Dept.

LT. ROGER I. EBY, San Francisco, Calif., has been ordered to active duty in the Bureau of Yards and Docks, Navy Dept.

LT. HENRY J. FITZPATRICK, Belmont, Mass., has been ordered to active duty at the Navy Yard, Boston, Mass.

LT. CHARLES MELVIN HERD, Pasadena, Calif., has been ordered to active duty at the Naval Air Station, Corpus Christi, Tex.

LT. BENJAMIN D. GOODIER, San Juan, Rizal, P. I., has been ordered to active duty in the Sixteenth Naval District.

LT. FRANCIS B. KELLY, Washington, D. C., has been ordered to active duty at the Navy Yard, Norfolk, Va.

LT. LOUIS R. LA PORTE, Brooklyn, N. Y., has been ordered to active duty at the Naval Operating Base, Hampton Roads, Va.

LT. JOSEPH A. MCHENRY, Arlington, Va., has been ordered to duty in the office of the Naval Inspector-of-Ordnance-In-Charge at Indianapolis, Ind.

LT. PAUL E. PARKER, Wellesley, Mass., has been ordered to duty in the Office of the Naval-Inspector-of-Ordnance-In-Charge, Canton, Ohio.

LT. RODY PATTERSON, Coraopolis, Pa., has been ordered to active duty in the Tenth Naval District, San Juan, Puerto Rico.

LT. GARNER W. REED, Katonah, N. Y., has been ordered to active duty at the Naval Air Station, Quonset Point, R. I.

LT. WILLIAM I. STEMWELL, Knoxville, Tenn., has been ordered to active duty in the Bureau of Yards and Docks, Navy Dept., Washington, D. C.

LT. JOHN G. WETZEL, Brooklyn, N. Y., has been ordered to active duty at the Navy Yard, Philadelphia, Pa.

LT. STANLEY P. ZOLA, Milwaukee, Wis., has been ordered to active duty in the Bureau of Yards and Docks, Navy Dept.

(*Continued on p.* 80)

The Genuine CROSBY CLIP is the one fastening with a safety record of more than fifty years. Designed right for greatest grip. Generously proportioned drop forged steel base. High, strong wings hold rope in place. Long bearing rope channel depressed to intensify the grip and grooved to the lay of the rope. Hot dip galvanizing defies rust, corrosion. Write for interesting manual (CCB-13) on fastening wire rope.

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CLUTCHES AND HYDRAULIC DRIVES
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Above: Twin Disc Model E Heavy-duty Clutch is standard on many leading makes of material handling equipment.

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(*Continued from p. 79*)

ALLAN G. JONES, during the last eight years serving as draftsman, project engineer, bridge designer and assistant bridge engineer with the Mississippi State Highway Department, Jackson, Miss., has joined the firm of Contractors Material Co., Jackson, Miss..

W. VINCENT BARRY, city engineer of New Haven, president of the Connecticut Society of Civil Engineers, and since 1938 acting director of public works of New Haven, has reported for duty with the U. S. Army at Fort Henry G. Wright. Mr. Barry is a reserve captain with the 301st Engineers, 76th Division, and has been assigned as assistant to the chief quartermaster in Zone No. 1.

The Pennsylvania Department of Highways has announced the following appointments to the engineering staff: LEO P. KINNEY, of Mercer, Pa., as assistant construction engineer, district No. 1, with headquarters at Franklin; and ROBERT L. FREW, of Everett, Pa., resident engineer, District No. 9, Hollidaysburg.

LEWIS B. SMITH, of Rochester, N. Y., veteran public works engineer and waterworks expert, has been appointed to the post of city superintendent of water. For the past four years Mr. Smith has been in charge of park improvements for the county highway department.

BRIG. GEN. ULYSSES S. GRANT 3D, grandson of the former President, was assigned April 9 to command the engineer replacement training center at Fort Leonard Wood, Mo.

JOHN M. POWELL, city engineer of Elyria, Ohio, since 1919, and a captain in the U. S. Army Reserve Corps since 1927, has received orders to report immediately to Fort Hayes at Columbus, Ohio, for a year's service as construction assistant in the Quartermaster's office. Captain Powell will be given a leave of absence from the city and no one will be appointed as acting engineer in his absence.

WILLIAM J. KNIGHT, Columbus, Ohio, has been appointed traffic and safety engineer for Division No. 11 of the Ohio State Highway Department with headquarters at New Philadelphia, Ohio. The appointment is in accordance with the recently announced plan of State Highway Director HAL G. SOURS of assigning a traffic engineer in each division to assist in facilitating the movement of traffic over the state highway system and to reduce accidents. Mr. Knight will work in cooperation with the planning engineer and route marking superintendent in the installation of control devices and the marking of highways.

(*Continued on p. 82*)

Joe tells why it costs less to quarry stone today

"QUARRYING SURE HAS IMPROVED. It's a good thing, too, or we'd never get out enough stone for all the new roads and the other construction for national defense.

"They tell me that powder costs alone have been cut 30% right here since the old days, and I can easily believe it. Just

take the saving on secondary shooting. What with these new powders and new ways of shooting, the rock's most all laid down ready for the shovel.

"It wasn't like that when I first came on this job. The stone wasn't broken up so nice, and it was pretty tough on those old shovels trying to load that big stuff.

"It was the Hercules people that started the ball rolling to cut down costs and boost production. They were the first ones to introduce Hercomite*—you know, the powder with lots more sticks in a case. Folks couldn't get the notion at first. But now look at it. Hercomite's used in quarries all over the country and it cuts costs nearly a third in some places.

"Of course, they've been improving Hercomite all the time; and then Hercules brought out that Gelamite* that we could use in wet holes, which saved some more money. You can use wagon drills, well drills, or coyote holes. It doesn't make any difference whether you shoot every day or only once a year, there's a way to do it with one of these Hercomites or Gelamites that will break the stuff just the way you want it.

"Yes, sir, we do a better job around a quarry now, what with the big improvement in the explosives, shovels, drills, and transportation equipment, too; and I figure a lot of the credit belongs to Hercules and the Hercules service men. They got there first with these modern high-count powders, and with all the researching and improving they're doing it looks as if they aim to stay ahead."

HERCULES POWDER COMPANY
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*Reg. U. S. Pat. Off., by Hercules Powder Co.

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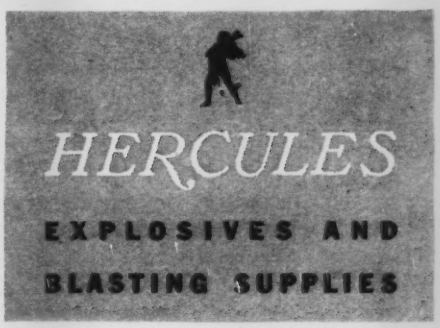

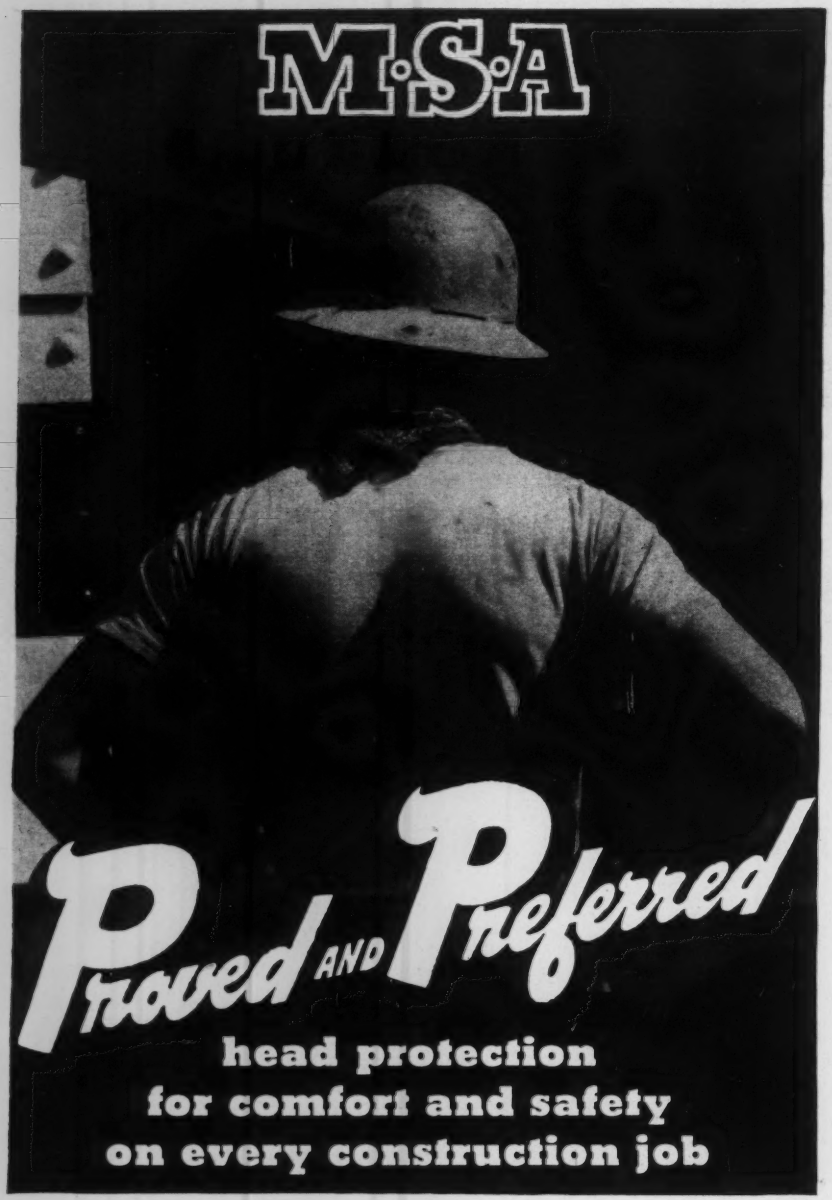

The job Skullgards have done *and are doing* in the construction field is known to the men who wear them—to management, insurance companies, state authorities—to everyone concerned with reducing head injuries and lowering costs.

That's why Skullgard, made of laminated Bakelite, *leads* in head protection—and is the favorite work hat of all industry. The facts on this strong, light, comfortable, durable hat will interest you. Send today for Bulletin DK-6!

MINE SAFETY APPLIANCES COMPANY
BRADDOCK, THOMAS AND MEADE STREETS, PITTSBURGH, PA.
DISTRICT REPRESENTATIVES IN PRINCIPAL CITIES

(*Continued from p. 80*)

HENRY W. JOHNSTON has recently retired from the dual post of city engineer and commissioner of works for the city of Halifax, Nova Scotia, after more than 35 years as an engineer in the employ of the city.

D. J. SIMMSONS, former project engineer on bridge construction, Mississippi State Highway Department, has resigned to take charge of engineering and housing projects at Pascagoula, Miss., where shipbuilding activities have necessitated expansion of housing and utilities.

W. T. WILLIAMSON, of the North Carolina highway and public works commission and formerly with the U. S. Engineers at Davenport, Iowa, has been named town manager at Apex, N. C., to succeed T. L. CORDLE, resigned.

STEPHEN J. MICHUDA has been appointed Chicago city engineer of bridges by City Engineer W. W. DEBERARD, to succeed the late THOMAS D. PIHLFELDT. After his graduation from Armour Institute of Technology, Mr. Michuda entered city service as a bridge designer in 1924.

C. P. HUMPHREY, who has been with the Idaho State Highway Department for 20 years—as director since May, 1940—has resigned to accept a position with the Morrison-Knudsen Construction Co. of Boise, Idaho.

Civil Engineering Corps officers called to active duty include: LIEUT. RICHARD W. SMITH, Coulee Dam, Wash., ordered to active duty in the Bureau of Yards and Docks, Navy Dept.; LIEUT. ERNEST B. SYKES, Philadelphia, Pa., was ordered to active duty at the U. S. Naval Training Station, Newport, R. I.; LIEUT. JOHN JUERGEN ALBERS, Glen Echo, Md., was ordered to active duty at Headquarters, Eleventh Naval District, Naval Operating Base, San Diego, Cal.; LIEUT. BEN R. ELLIOTT, Denver, Col., was ordered to active duty in the Bureau of Yards and Docks, Navy Dept.; LIEUT. ARTHUR P. GARDINER, Olympia, Wash., was ordered to active duty in the Fourteenth Naval District, for which the headquarters is Honolulu, T. H.; LIEUT. WILLIAM MADISON GORDON, Russellville, Ark., was ordered to active duty at the Naval Air Station, Jacksonville, Fla.; LIEUT. NORMAN MARTIN MARTINSEN, Seattle Washington, was ordered to active duty in the Bureau of Yards and Docks, Navy Dept.; LIEUT. JAMES R. BOLLINGER, Los Angeles, Cal., was ordered to active duty in the Bureau of Yards and Docks, Navy Dept.; LIEUT. WILLIAM E. DAVIDSON, Oakland, Cal., was ordered to active duty in the Bureau of Yards and Docks, Navy Dept.; LIEUT. WILLIAM W. DAVIS, Pensacola, Fla., was ordered to active duty at the Navy Yard, Boston, Mass.

APPROVED *for* BETTER SERVICE

HUNDREDS of diversified industries continually give their stamp of approval to Graver-built equipment—and they approve it because it is built to render dependable, long-term service.

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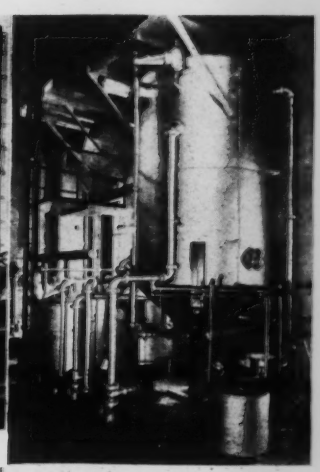
GRAVER CONSTRUCTION DIVISION

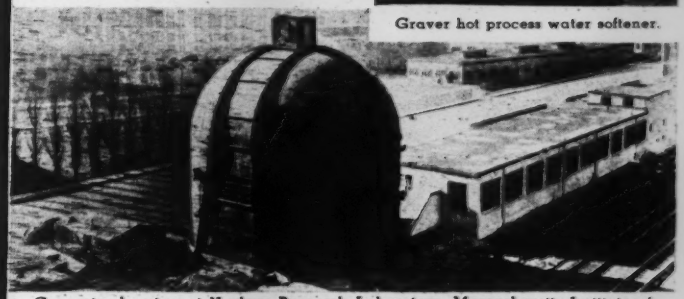
Graver has complete facilities to handle erection of processing equipment and other facilities for industry.

Fully equipped with tools, erecting equipment and experienced personnel—this division can assure efficient handling of any construction project regardless of size. *Full details will be sent upon request.*

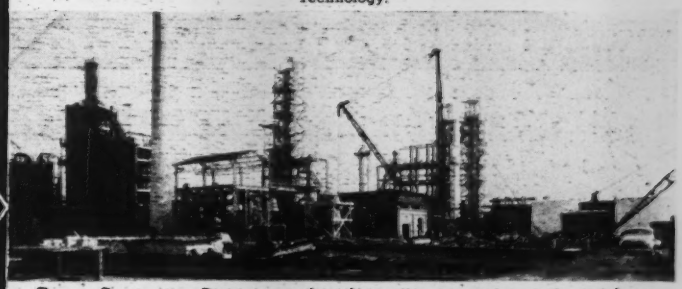
Steel stacks for open hearth furnace.



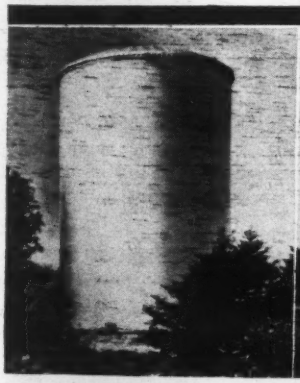
Graver hot process water softener.



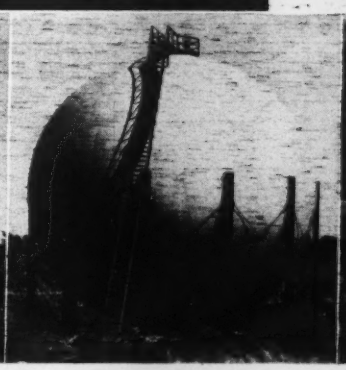
Generator housing at Nuclear Research Laboratory, Massachusetts Institute of Technology.



Graver Construction Division—on the job erecting processing equipment for a major oil company.



Butt-welded standpipe; Dia. 66', height 100', capacity 2,500,000 gallons.



Welded sphere for storage of volatile liquids designed for 20 lb. working pressure.

All welded twin steel tubes for under water crossing—Chicago subway system. 23 ft. high—40 ft. wide—200 ft. long—weight 525,000 lbs.

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Equipped with pneumatic tires...Timken bearings...8-ft. 6-in tool head ...12 1-in. square standards and ¼-x4-in. double-end points. Working depth regulated by crank. Vibrating action of double coiled, spring steel standards insures thorough material mixing. Available with 42-in. or 70-in. wheel tread. 26 states now processing secondary roads. Mixer, Ripper, Harrow and Scraper specifications for this work are included in *FREE* folder, "Processing Soil-Cement Roads." Write for yours.

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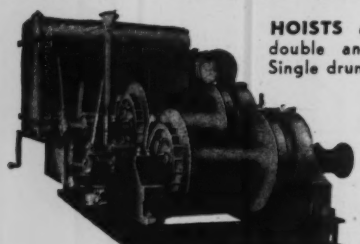

HOISTS come in single, double and triple drums. Single drum for elevators, pulling mine cars. Double drum for dragline or derrick work. The 3 drum for clam shell bucket and similar three lines work. Sizes from 8HP up to including 150HP.

COMPRESSORS are built in single and 2 stage from 85 cu. ft. to 210 cu. ft. actual air delivery, 100# pressure. Semi-portable, mounted on skids; 2 wheel spring mounted trailer type; and 4 wheels, solid or pneumatic tires; can be mounted on automobile chassis. Have multiple disc friction clutch, adjusted at the factory, never needs adjusting. The 2 stage have air cooled intercooler—single stage have an air cooled aftercooler. O.K. Compressors deliver coolest air.

ELEVATORS have gin pole for quick erection. A 2 or 3 section elevator erected with 2 or 3 men in less than one hour. Erection done by hoist itself—no hand power or hoisting needed. Will service with single platform 35 to 40 bricklayers; with double platform 35 to 60 bricklayers. 3 sizes 8HP., 15HP., and 25HP. The 25HP. will lift 10 or 12 cu. ft. of concrete in a bucket or buggies.

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MEETINGS

HEATING, PIPING and AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, St. Francis Hotel, San Francisco, Cal., June 16.

AMERICAN WATER WORKS ASSOCIATION, 61st annual convention, Royal York Hotel, Toronto, Ont., June 22-26.

REGIONAL AND LOCAL MEETINGS

WISCONSIN ENGINEERING CONFERENCE, Pfister Hotel, Milwaukee, Apr. 28-30.

MARYLAND-DELAWARE WATER AND SEWERAGE ASSOCIATION, 15th annual conference, Raleigh Hotel, Washington, D. C., May 8-9.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS, INC., annual convention, Hotel Commodore, New York City, May 8-10.

AMERICAN SOCIETY OF CIVIL ENGINEERS, spring meeting, Texas section, Faust Hotel, New Braunfels, Tex., May 9-10.

NATIONAL CONFERENCE ON PLANNING, Philadelphia, Pa., May 11-13.

AMERICAN WATERWORKS ASSOCIATION, SOUTHEASTERN SECTION, annual conference, Fort Sumter Hotel, Charleston, S. C., May 12-14.

UPPER PENINSULA WATER WORKS ASSOCIATION, Escanaba, Mich., May 14-15.

NEW JERSEY SECTION, AMERICAN WATER WORKS ASSOCIATION, spring meeting, May 22, Newark, N. J.

EASTERN PHOTOELASTICITY CONFERENCE, 13th semi-annual meeting, Massachusetts Institute of Technology, Cambridge, Mass., June 4-13.

UPPER PENINSULA Road Builders Association, Ironwood, Mich., annual convention, June 12-13.

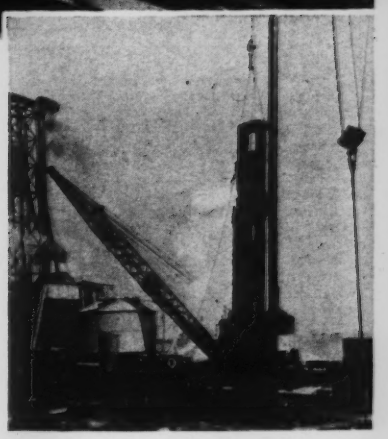
PUBLIC HEALTH ENGINEERING, short course, water, sewage and camp sanitation—Massachusetts Institute of Technology, Cambridge, Mass., June 16-July 25.

CAROLINA BRANCH, ASSOCIATED GENERAL CONTRACTORS, Ocean Forest Hotel, Myrtle Beach, S. C., July 11-12.

ELECTIONS AND ACTIVITIES

ALEXANDER BLAIR of Lake Placid, Fla., was elected president of the Florida Engineering Society at the annual convention on Mar. 22, in Tallahassee. Mr. Blair succeeds Joseph Weil, dean of the University of Florida Engineering College, who received the society's annual medal for outstanding service to the organization. Engineering for defense was the main topic of discussion at the convention. J. Wylly Keck

ON NEW YORK'S EAST RIVER DRIVE...



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provide safe and economical foundation

ALL along the East River waterfront are buried stone-filled cribbing, sunken barges, old brick and concrete from obsolete buildings—an accumulated mass of debris that makes driving conditions tough and uncertain. Fortunately, the engineers in charge were able to draw upon the lessons learned ten years ago in the construction of New York's famous West Side Express Highway where 130 miles of NATIONAL Pipe Piles were used with remarkable success to meet similar sub-surface conditions.

By choosing NATIONAL Pipe Piles for the East River Drive, they were able to overcome all driving difficulties and have produced a foundation that meets every requirement of strength, permanence and economy.

There are good reasons why NATIONAL Pipe Piles will solve your foundation problems. They penetrate where other pilings fail. They have greater supporting strength. They cost less for deep and difficult penetrations. They can be inspected full length after driving. No other type of foundation piling offers all these advantages.

May we send you Bulletin 27? It gives complete engineering information and descriptive details on many projects employing NATIONAL Seamless Pipe Piles.

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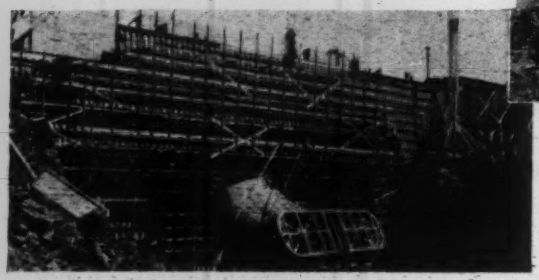
ON JOBS LIKE THIS!



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INDIAN
FIRE PUMPS

Armco 5 gal. rust-resistant tank
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50 ft. stream
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Extra strong construction throughout

Patented

Think what havoc fire could cause here! Be prepared. Have INDIAN FIRE PUMPS handy for instant use. INDIANS are the fast, positive way to extinguish all fires. Used and recommended by Foresters, Fire Depts., Lumbermen. Quick use of an INDIAN stops fire before it spreads. A liberal supply of these pumps costs very little in comparison with the thousands of dollars invested. Tanks may be kept continually filled without rust or corrosion.

Send for Catalog, Price List

D. B. SMITH & CO., 418 Main St., Utica, N. Y.

PACIFIC COAST AGENTS:

Hercules Equipment & Rubber Co., 550 Third St., San Francisco, Cal. — Carco-Conwhit Sales Co., 520 S.W. Pine St., Portland, Ore. — Mill and Mine Supply, Inc., 2700 4th Ave. S., Seattle, Wash.

Roy G. Davis Company 617 E. 3rd St., Los Angeles, Cal. The Conwhit Company, Klamath Falls, Oregon

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GOODALL CONCRETE PLACING HOSE

Exceptionally durable and economical for bends in the pipe line and other points where flexibility is essential. Wear resisting tube. Numbered 1 to 4 around cover so that hose can be readily checked and turned to insure uniform wear.

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Please quote on ..... ft. of Concrete Placing Hose....I.D. with (check which)
☐ "Flang-Lok" Ends ☐ Reg. Iron Pipe Nipples

Company .....
Address .....
City & State .....
Att. of .....

of Miami, was elected treasurer, and John O. Jackson of Jacksonville, and M. B. Garris of Coral Gables, directors.

MINNESOTA HELD ITS FIRST traffic engineering conference the week of Mar. 25 at the University of Minnesota. The conference was sponsored by the Center of Continuation Study, University of Michigan, in cooperation with the Minnesota highway department, and the League of Minnesota Municipalities. The Center for Continuation Study is a unique institution where professional people and others may take a special pre-arranged course to bring themselves up to date in their chosen work. About 81 persons attended the course.

A. R. TRIMMS of Welland, Ont., has been elected president of the Ontario General Contractors Association.

DANIEL B. NIEDERLANDER has been named vice president and general manager, by the board of directors, of the John W. Cowper Co., constructors of Buffalo, N. Y. John W. Cowper, Jr. was appointed secretary. The Cowper Company has the general contract for construction of Pine Camp and the new Curtiss-Wright plant.

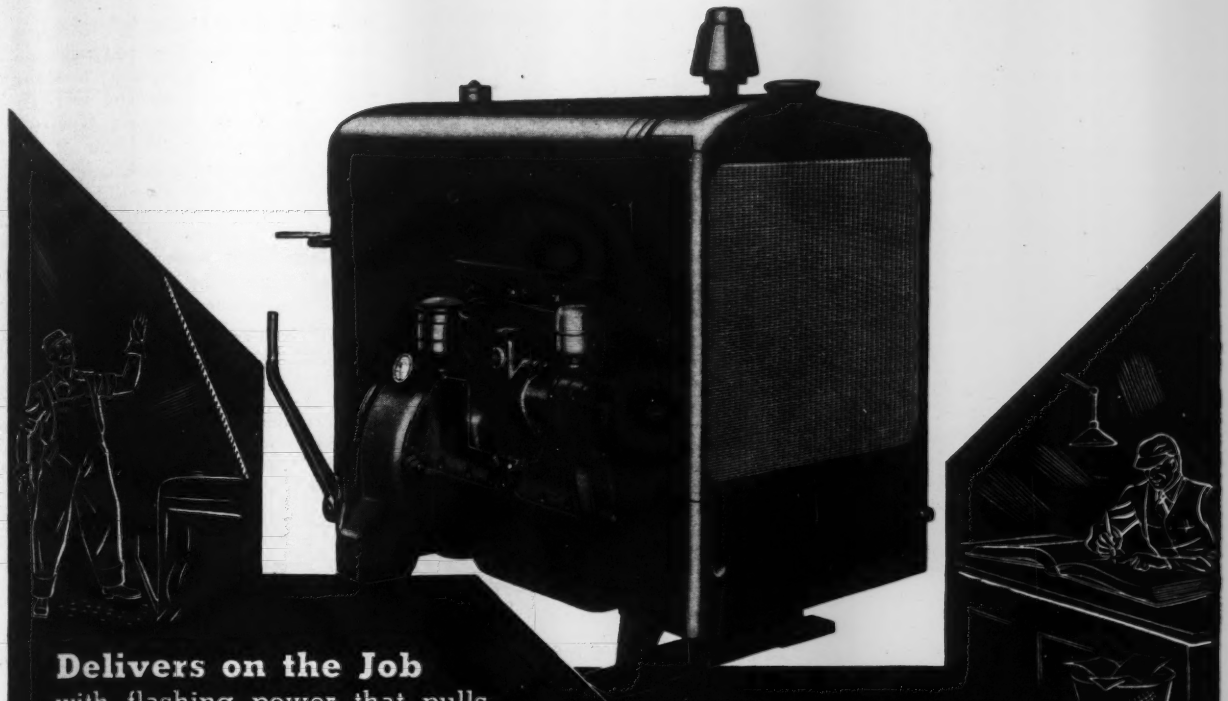
THE IOWA ENGINEERING SOCIETY has adopted a new constitution providing for full-time employment of a secretary and L. L. Flint has been appointed to this office. Mr. Flint has been managing director of the professional division, branch of the society, which under the old constitution, devoted full time activities to the improvement of the professional status of Iowa engineers. C. Moriarty has been made treasurer.

J. S. Dodds, who has been secretary-treasurer for the past 18 years, retires from that part time position under the new constitution. The society has more than 500 members. "The Exponent," new monthly magazine, has been made official publication of the society, and the new office is located in the Old Colony Building, Des Moines, Iowa.

W. W. MITCHELL, state highway director for Arkansas, is the newly elected president of the Little Rock Engineers' Club, with David Greer, vice president, Fred J. Herring, secretary-treasurer, and V. E. Scott, a director.

PROF. W. E. CORNISH OF Edmonton, Ont., was elected president of the Association of Professional Engineers of Alberta, at their annual meeting held on Mar. 22.

THE NIAGARA FRONTIER BUILDERS ASSOCIATION, Buffalo, N. Y., on Mar.



Delivers on the Job
with flashing power that pulls you through the pinches . . . and keeps going through thick and thin.

Delivers on the Cost Sheets
to give you an extra edge of profit — with low initial cost . . . low maintenance cost . . . low fuel cost . . . less lost time.

This LeRoi Power Unit on

- ✓ **Pumps**
- ✓ **Hoists**
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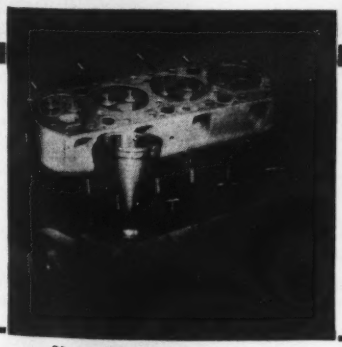
means more H.P. hrs. per $



Above: Illustrating removable sleeve construction

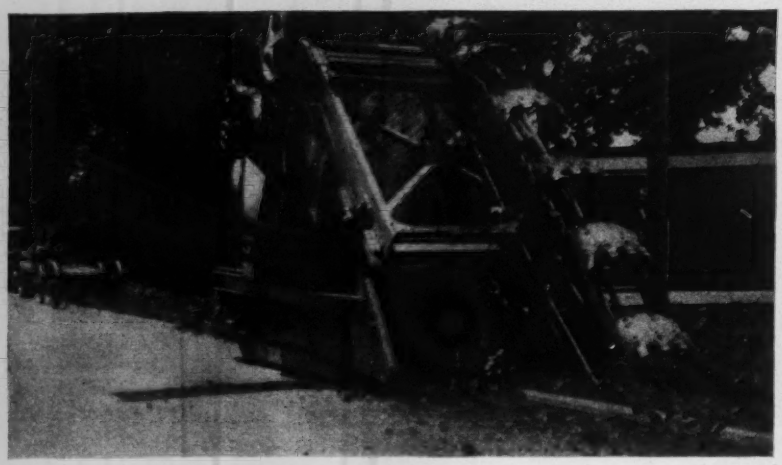
LEROI D201

Out on the job, there's no time for pampering either men or machines. Both have to stand the gaff when the going is "hot and heavy" . . . and deliver results that show a profit when your cost sheets are totaled. • Le Roi's D201 power unit on your equipment assures you of that kind of dependability. • It's got "guts!" It's designed and built that way: *Finest materials*—exacting standards of production — thorough testing and inspection assure reliable service . . . safeguard against excessive lost time and repair costs in heavy-duty service. • *Overhead valve arrangement* means ready accessibility, fuel economy, lower operating costs. • *Removable wet sleeve cylinders* are easily and inexpensively replaced. Eliminate reboring, and assure uniform expansion and true cylinder bores. Reduce wear, permit accurate control of cylinder lubrication, eliminate oil pumping. • *Fully enclosed* for protection against tampering and bad weather. • *Many other features* that have proved themselves in the field on thousands of jobs. • There are Le Roi engines in a complete range of sizes for every construction requirement. Results justify your good judgment in insisting on Le Roi. Look for—ask for—Le Roi power when you buy your next piece of equipment.

Write for free Bulletin 201C.

LEROI COMPANY • MILWAUKEE, WISCONSIN

Parsons TRENCHERS



We'll Move the Earth to Serve You

PARSONS name has identified dependable excavating equipment for almost forty years.

Always designed with modern engineerings methods, plenty of power, ruggedness, and above average capacities to meet the demand for faster, better built ditchers.

PARSONS has pioneered nearly every major improvement for trenchers. The first to use the ladder type boom, power steering, crawler type mounting, power shift conveyor, offset boom, and ball and roller bearing mounted enclosed machinery. The leader now as always. Often copied, but never equaled.

PARSONS offer both semi and full crawler mounted Trenchers for depths up to 15 feet and widths up to 54".

Let us help you on your next ditcher or backfiller application.

Pick a Parsons and Quit Picking

THE PARSONS CO. • NEWTON, IOWA

Dealers in Principal Cities • *Division of Koebring Co.*

STEEL FORMS

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AIR LOCKS

TUNNEL SHIELDS

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ROBERT S. MAYO

TUNNEL EQUIPMENT

LANCASTER PENNSYLVANIA

28 elected the following officers: president, G. Lawrence Mitchell; vice president, Arthur H. Steinmiller; treasurer, Frank E. Weber; executive secretary, George F. Prong; secretary, G. Harold Genrich; directors, William H. Albright, Herman C. Bredlau, Robert Hurst, William H. Merrill, and Raymond C. Dewey.

HARRY CLYDE ANDERSON, district engineer, department of public works, New Westminster, B. C., has been elected a member of the Engineering Institute of Canada.

R. W. COLLINS of the Southwestern Construction Co. has been elected president of the Houston, Tex., chapter of the Associated General Contractors, succeeding W. S. Bellows. Chris J. Miller was elected vice president, and E. A. Fretz treasurer. Mr. Fretz succeeds S. Knutson, who has held the office of treasurer since 1937. Loy W. Duddlesten was reelected secretary.

J. S. WILLIAMSON was elected chief state highway commissioner of South Carolina for a full term of four years at a meeting on Mar. 20 of the highway commission. Mr. Williamson had been serving in this office since December, filling the unexpired term of the late Ben M. Sawyer, whose term would have expired April 1.

H. H. HENNINGSON, consulting engineer, announces the removal of his office and that of the Henningson Engineering Co., Inc. to 626 Standard Oil Company Building, 18th and St. Marys Avenue, Omaha, Neb.

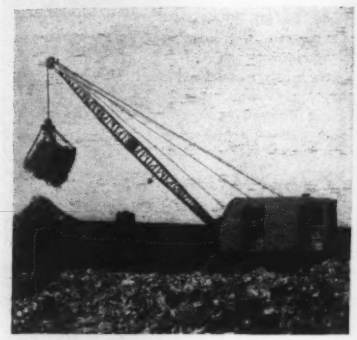
ALBERT HAERTLEIN, Gordon McKay professor of civil engineering in the Harvard Graduate School of Engineering, was elected president of the Boston Society of Civil Engineers at their annual meeting in Boston. Mr. Haertlein succeeds A. L. Shaw of Metcalf & Eddy, Boston consulting engineers. Other officers elected were: E. N. Hutchins, Massachusetts Department of Public Works, was re-elected secretary; Charles R. Main, of Charles T. Main, Inc., Boston consultants, and A. B. Edwards, Massachusetts State Planning Board, vice-president, and Charles L. Coburn, Metropolitan District Water Supply Commission, treasurer.

R. J. TEMPLETON, of Cheyenne, Wyo., has been elected preisdent of the Wyoming Engineering Society. Mr. Templeton is construction engineer with the Wyoming State Highway Department. Other officers elected were: Earl Lloyd, of Cheyenne, deputy state engineer, vice president; Kirby Olds, secretary-treasurer.

New Aids to the Constructor?

High Speed Developer

A new BW developing machine for high speed print production has been announced by Bruning for use with their Model "75" BW printer. Known as the No. 159 volumatic sheet developer, the machine consists of a separator roll, water roll and a series of bands which carry the developed prints through the drying section. The application of a positive vacuum separator, which separates the tracings from the exposed prints, is said to be entirely new.—*Charles Bruning Co., Inc., 100 Reade St., New York City.*



Light Weight ¾-Yd. Convertible Shovel

A new, light weight ¾-yd. convertible shovel-dragline-crane, Model 75, is announced by Link-Belt Speeder Corp., as a companion to its popular LS-85 heavy-duty ¾-yd. machine. All welded steel construction has replaced castings in the new Model 75. Power plant is a heavy-duty gasoline or diesel engine with smooth-running roller chain drive. A large diameter turntable and long, wide crawlers give the Model 75 extra stability on slopes and in heavy digging.—*Link-Belt Speeder Corp., Chicago, Ill.*

Air Hose

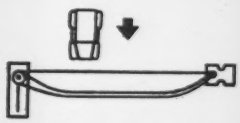
A new brand of molded and braided air hose has been developed for rough use in mining and construction work. Known as the "Mine King," the hose has special endurance against gouging and abrasive abuse to the cover, dampness and separation in the hose wall, and to oil from compressors through the tube.—*Goodall Rubber Co., 5 So. 36th St., Philadelphia, Pa.*

Color on Galvanizing

A new galvanized sheet which is subjected to chemical and metallurgical processes that change the surface fin-

STOP IT!..at 1/10 the cost with the HIGHWAY GUARDIAN

HOW IT WORKS



1. Car approaches barrier lowered by oncoming train. . . .

2. Car strikes barrier—"bow string" takes initial shock and grips car — snubber starts to move forward. . . .

3. Car brought to stop within 10 feet, all momentum gently checked. Note how snubber has moved up.

● Despite the millions spent on grade-crossing eliminations in recent years, crossing fatalities are on the increase—*1,113 in the first eight months of last year!* This is a higher total than for any corresponding period in the last ten years.

The answer? . . . HIGHWAY GUARDIAN, the automatic crossing gate motorists won't crash! And it insures 100% grade crossing protection at one-tenth the cost of a crossing elimination.

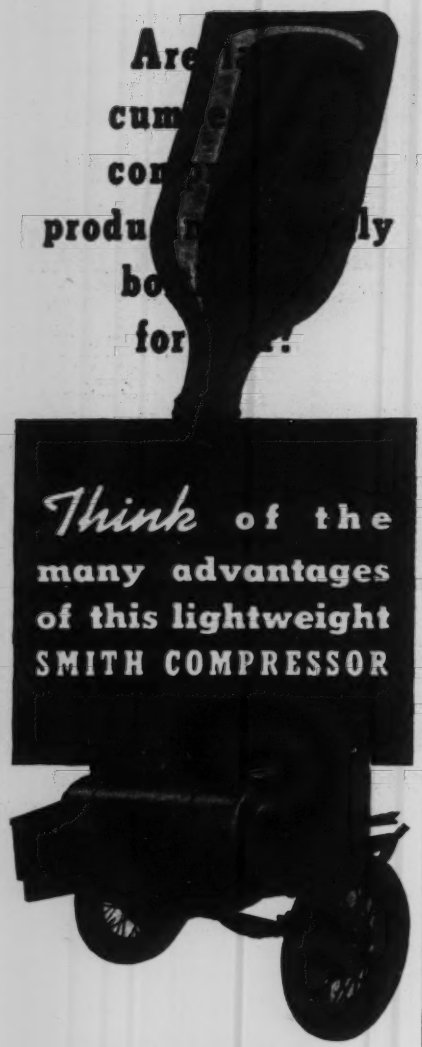
In other words, for the cost of one elimination approximately ten crossings can be made absolutely safe!

Safely, gently, the Highway Guardian brings the endangered vehicle, to a full stop within a short predetermined distance — checks momentum without violent shock—keeps the vehicle off the tracks!

Under observation of highway and railroad safety engineers, two installations operating for more than a year have proved how the Highway Guardian meets the grade crossing problem as no other economically feasible protection has ever done.

Your inquiry creates no obligation . . . write now for details.

HIGHWAY GUARDIAN CORP., Sixth & Lloyd Sts., Chester, Pa.



Think of the many advantages of this lightweight SMITH COMPRESSOR

PORTABILITY

Think of the many advantages of such a lightweight, portable compressor! Move it easily from one job to another. Tow it at permissible truck speeds.

DEPENDABILITY

Made with FORD MOTORS and standard parts. Its ruggedness and efficiency are sources of constant satisfaction to users everywhere. Repairs and parts available at any Ford garage.

ECONOMY

Priced far below standard compressors of equal capacity. 60 cu. ft. size uses only 1 gal. of gasoline an hour!

Head equipped with high speed compressor valves; automatic unloading and idling.

With a Ford Motor and shop facilities you can assemble your own Smith Compressor. We will furnish a Smith Compressor Head and Accessories with complete instructions for mounting.

Write for free booklet

GORDON SMITH & CO.
430 College St. Bowling Green, Ky.

★ Smith ★
AIR COMPRESSORS

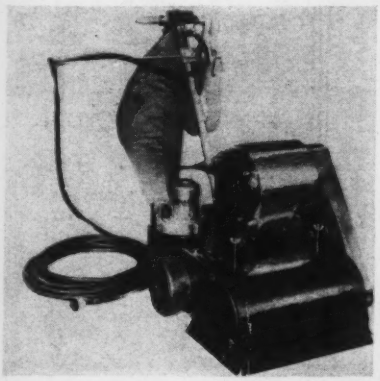
ish without weakening the protective spelter coating, is now available under the name "Colorbond" designed to hold paint on galvanized sheets so that paint coats become an integral part of the finish rather than simply a layer of paint. "Colorbond" is easily fabricated and formed without special tools and is made from various base metals.—*The Newport Rolling Mill Co., Newport, Ky.*

Drawing on Aluminum

A new process known as "Photo Sensitized Metal" is a photographic metal on which copies can be made by the usual contact printing method or with an enlarger from an ordinary drawing, regular print or negative. Aluminum is used as a base and no special treatment or expensive equipment is necessary in processing. The manufacturer recommends the usual steps of development and fixation followed in processing ordinary film. It is said that because of its slow speed the metal has an additional advantage in that no special darkroom is required. It is claimed to give exact scale copies of drawings, photographic plates, etc.—*Republic Engineering Products, Inc., 480 Lexington Ave., New York City.*

Roofs

Revere has announced the introduction of Roofloy, an improved type of roofing sheet lead for which the advantages of lighter weight, greater tensile strength, lower installation cost and reduced tendency to creep are claimed. Roofloy can be employed for any of the uses to which ordinary sheet lead is now put and requires only 2 lb. per sq.ft. for most needs. A descriptive booklet is available.—*Revere Copper & Brass Inc., 230 Park Ave., New York City.*



Floor Cleaner

The Model K floor machine, shown above, is designed to clean floors of large industrial plants without use of

"What's all this about WINNER Techno-TONE?

The boys in the drafting room are all excited about a new drawing pencil. Hmm . . . if it's an A. W. FABER product, I'm interested."

"I used A. W. FABER Drawing Pencils before you were born!

Began my career at a drafting table when Cleveland was president . . . WINNER Techno-TONE is just what I expected. Smooth as silk. Uniform in all 17 degrees. Since the war has curtailed "CASTELL" *(world's best)* I'm mighty glad to get WINNER Techno-TONE, *America's best* drawing pencil!"

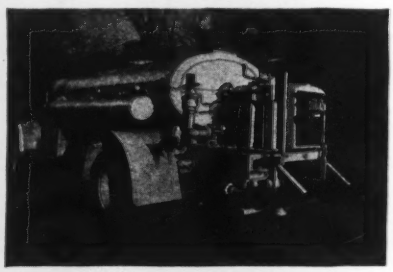
THE HOUSE OF AW FABER "CASTELL" STANDARD OF THE WORLD

2 for 25¢

Polished bright green. Packed in metal boxes. Send for sample of degree you most frequently use.

WINNER Techno-TONE 17 Degrees—6B to 9H "It has the A.W. FABER name on it."

A·W·FABER-Inc. NEWARK N.J.



KINNEY DISTRIBUTORS

When you purchase a Kinney Distributor you get a machine that measures bitumen accurately on the road surface; simple piping, simple, easily operated controls; pump, engine, and valves easily accessible for proper care by the operator; good weight balance to cut your tire expense; and important safety features. Circulating spray bar available, at additional cost.

Write for Bulletin A—Kinney Manufacturing Co., 3527 Washington Street, Boston, Mass.

Kinney

soap or water. In addition to this maintenance function it serves as a powerful sander for reconditioning old wood floors or to obtain a smooth surface on those newly installed.—*G. H. Tennant Co., Minneapolis, Minn.*

Road Bases

A completely revised and greatly enlarged edition of the booklet "Better Bases for Better Roads" has just been issued by Solvay. This new edition contains new data, new specifications and new information on base construction and maintenance. It includes such information as A.A.S.H.O. specifications, recent Public Roads Administration test data and a comparison of roller versus shrinkage compaction as determined by shear tests.—*Solvay Sales Corp., 40 Rector St., New York City.*

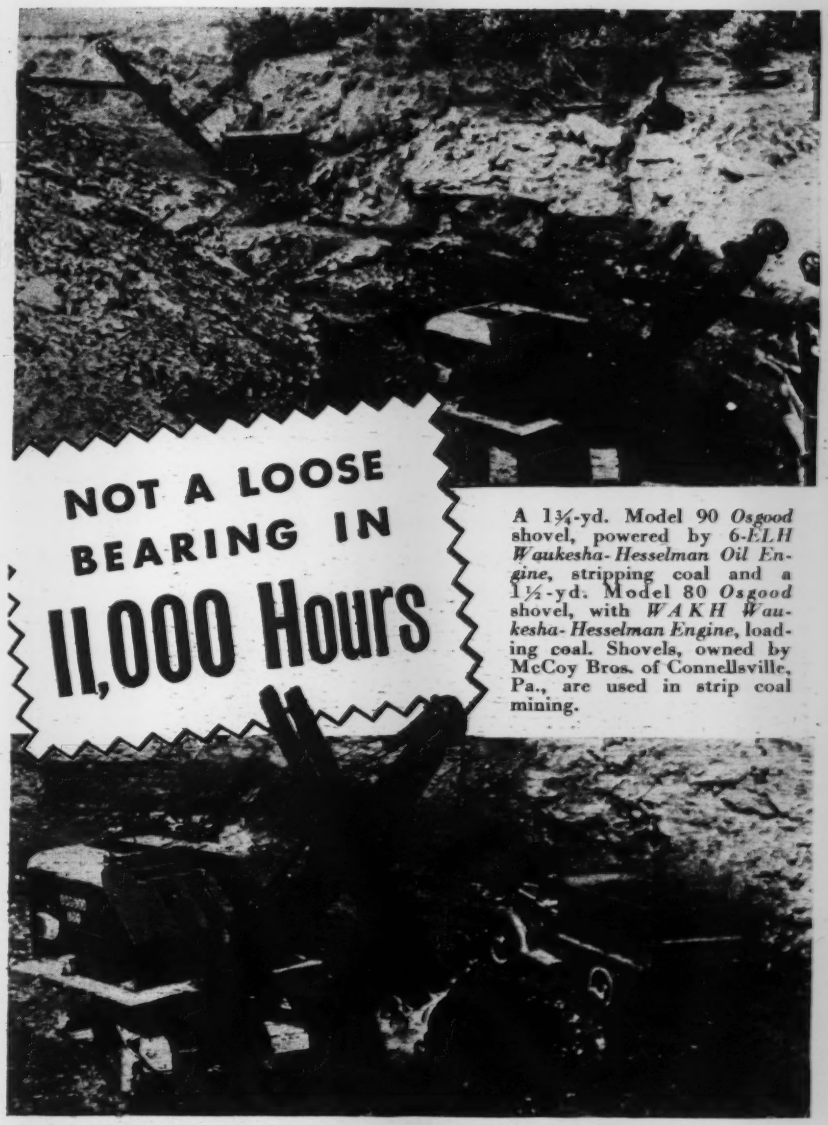
Masonry Waterproofing

A colorless synthetic mineral gum, reduced with a volatile to form a liquid compound, is now available for waterproofing application on masonry surfaces by means of a brush or spray and is sold under the trade name of Hydrozo. The compound is claimed to penetrate the pores of the masonry to a depth of ¼ to ¾ of an inch, and to be suitable for application to the finest masonry surfaces without changing their appearance.—*Hydrozo Waterproofing Products, Madison, Wis.*

Concrete Floor Finisher

Shown above is a manually handled Grill Tamper designed to knock down heavier aggregates in concrete floor construction so that sufficient mortar is on the surface to permit troweling without dry topping.

Also available is a precision cement floor finisher, a gasoline or electric motor driven machine with a three-bladed feathering propeller trowel arrangement 46 in. diam. The machine is simple in operation, a slight turn of the wheel on the operator's end of the handle giving instant tilt to the rotating trowels, setting them to micrometrical



A 1¾-yd. Model 90 *Osgood* shovel, powered by 6-*ELH Waukesha-Hesselman Oil Engine*, stripping coal and a 1½-yd. Model 80 *Osgood* shovel, with *WAKH Waukesha-Hesselman Engine*, loading coal. Shovels, owned by McCoy Bros. of Connellsville, Pa., are used in strip coal mining.

WAUKESHA OIL ENGINES

Working 11,000 hours in a shovel stripping coal at 185 cu. yds. per hr., and the engine's original bearings are still running perfectly. It's a 6-ELH Waukesha-Hesselman—and it's "the real McCoy." Ask the owner, Mr. Francis M. McCoy. He says that there was no appreciable cylinder wear either, when the last interior inspection was made, after 8000 hours.

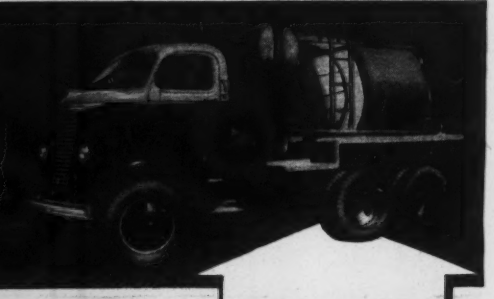
He has another Waukesha-Hesselman Engine, a 6-WAKH, in a shovel loading 125 tons of coal an hour. It shows no signs of loose bearings, after 3,600 hours.

Low pressures and precision-timed spark ignition give results like these in an oil engine. Starting is easier than with a gasoline engine. Cylinders, pistons, rings and bearings last longer. Repairs are fewer. And a Hesselman burns low-cost, easy-to-get fuel oils, giving you an over-all economy second to none.

Write for Bulletin 1200.

WAUKESHA MOTOR COMPANY · WAUKESHA, WIS.
NEW YORK TULSA LOS ANGELES

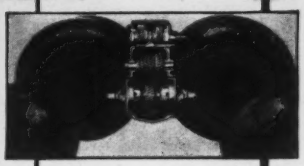
HAUL BIGGER LOADS



GET MORE TRACTION

Two axles under the load are far better than one! **THORNTON Four-Rear-Wheel DRIVE** doubles capacity and tractive effort. Cuts investment 25 to 40%. Reduces upkeep 30 to 50%.

Saves money for operators in scores of industries.



THORNTON TANDEM CO.

8701-8779 GRINNELL AVE. DETROIT, MICH.

Manufacturers also of the THORNTON automatic-locking DIFFERENTIAL which gives traction when slippery going makes trucks equipped with ordinary differentials helpless.

"When you need TRACTION you need THORNTON"

MASTER No. 23 GAS CONCRETE VIBRATOR ON RUSH JOBS TODAY

DEPENDABILITY means maximum yardage placed daily

Master Equipment is competitive in price and is built of the very highest quality of material and workmanship and gives the utmost in performance with long life and uninterrupted service in the use of same.

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- Gas-Electric Generator Plants, 500 Watts to 240 KVA—AC or DC.
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- Complete Line of High Speed Tools.

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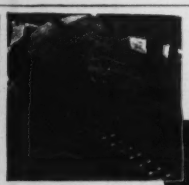
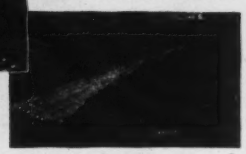
MASTER VIBRATOR CO., DAYTON, OHIO

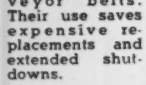


KEEP YOUR CONVEYOR BELTS GOING



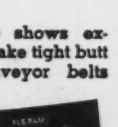
FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. Their use saves expensive replacements and extended shutdowns.

● **Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.**



FLEXCO H D BELT FASTENERS make a strong, tight butt joint with long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Six sizes in steel and alloys.

Bulletin F-100 shows exactly how to make tight butt joints in conveyor belts with Flexco. Also illustrates step by step the latest practice in repairing rips and putting in patches.



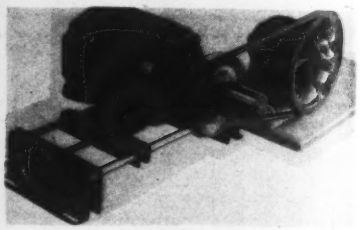
FLEXIBLE STEEL LACING CO.
4656 Lexington St., Chicago

Write for your copy.

FLEXCO HD BELT FASTENERS

Sold by supply houses everywhere

adjustment of the pitch while the machine is in motion. The outfit makes not only a flatter, smoother floor possible but is claimed to eliminate all riffles and small depressions commonly found in hand finished floors.—*Whiteman Mfg. Co., 3249 Casitas Ave., Los Angeles, Calif.*



Variable Speed Pulley

Shown above is a new variable speed pulley designed for light, inexpensive machinery. The complete unit includes a variable pitch pulley and an adjustable sliding motor base. By turning the hand wheel of the base the motor moves backward or forward, causing an increase or decrease in belt tension which causes the pulley to open and close, changing the pitch diameter and the driven speed. Speed changes can be made while the drive is running. Speed ratios up to 2¾ to 1 are available and in sizes up to ¾ hp.—*Ideal Commutator Dresser Co., Sycamore, Ill.*

Hydraulic Jack

As an addition to their broad line of lever and screw jacks, Simplex has recently announced 3-, 5-, 8-, 12- and 20-ton capacity heavy duty hydraulic jacks. The manufacturer claims many design and construction advantages including neoprene oil resistant seals, pressure-tested malleable iron top nut and base, a machine ground ram, a fully lapped cylinder, needle type load release, and a convenient carrying handle. Dealer stocks are available in industrial centers throughout the country. Bulletin HD-41 illustrates and describes the line.—*Templeton, Kenly & Co., 1020 S. Central Ave., Chicago.*

Portable Generating Plants

The Bardco line of generating plants has recently been broaded by the addition of seven air-cooled units, and ten water-cooled totally inclosed models, that are designed to be easily portable and entirely self-contained. The air-cooled units are 500, 1000, 1500 and 2000 watts at 6, 12, 32 or 110 volts d.c. or 110-220 volts a.c. Water cooled units are available in 3 and 5 kw. sizes a.c. or d.c. The Master generators used on both air-cooled and water-cooled plants are of the inherent voltage regulation type. — *Bardco Mfg. & Sales Co., Dayton, Ohio, or Los Angeles, Calif.*

NEW PUBLICATIONS

Electrical Progress—"Electrical Developments of 1940" is the title of a sixty page booklet describing electrical progress during 1940. Ask for Bulletin GEC 892—*General Electric Co., Schenectady, N. Y.*

Truck Hoists—Bulletin No. 2 describes Gar Wood cam and roller hoists for installation on all sizes of trucks. Bulletin No. 11 gives information on hydraulic repair towers for truck mounting for use on overhead repair and maintenance work—*Gar Wood Industries, Inc., Detroit, Mich.*

Elevated Tank—A 20-page bulletin entitled "Radial-Cone Bottom Elevated Water Tanks" illustrates structural and cylindrical column installations ranging from 125,000 to 2,000,000 gal. capacity tanks. The illustrations are arranged so that it is easy to compare different construction features and a table of standard sizes is included.—*Chicago Bridge & Iron Co., Chicago.*

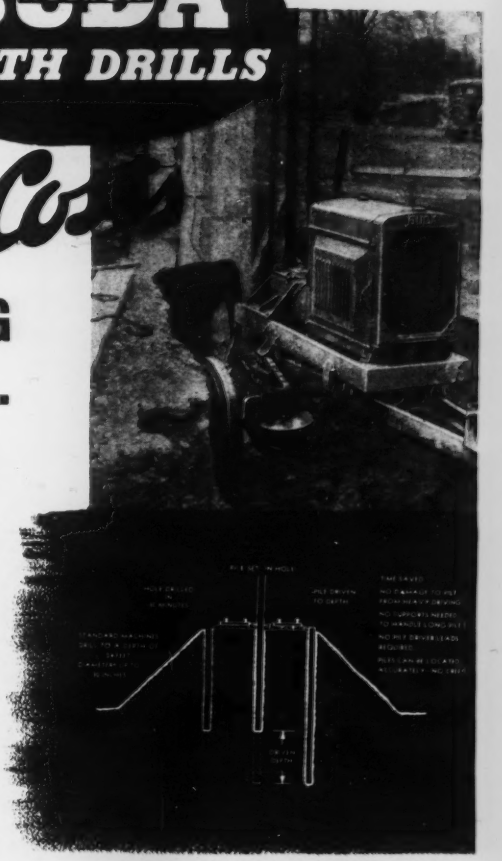
Screens—An 8-page booklet describes a new screen which is said to be the only one with two distinct actions—shaking and whipping. The booklet gives details of construction and operation, with particular emphasis on exclusive Hendrick features.—*Hendrick Mfg. Co., Carbondale, Pa.*

Gas Cutting—A 26-page bulletin has been published by Air Reduction to make available convenient descriptions of the various newly-developed machines for aiding fabrication by welding in the marine industry. Illustrative photographs display each of the machines and their functions in detail.—*Air Reduction 60 East 42nd St., New York.*

Road Machinery—Adams has released new advertising on motor grader #412 with the 58½-hp. diesel engine, motor grader No. 201 with 31 hp. gasoline engine, snow plows and snow wings for use with Adams motor graders, and information on a power control unit.—*The J. D. Adams Co., Indianapolis, Ind.*

Gas Welding and Cutting—A well illustrated 48-page catalog covers the comprehensive line of Victor gas welding and cutting apparatus. Cut open sections of various regulator types and of its major welding torch, in three colors, offer a clear picture of the design and construction features as well as the path which gases travel through these devices.—*Victor Equipment Co., 844-50 Folsom St., San Francisco, Calif.*

USE BUDA HUBRON EARTH DRILLS to Cut Costs on PILING WORK . . .



THE trailer-mounted Buda - Hubron Earth Drill shown here is working on a grade separation project, which calls for fast, accurate preboring of 14' x 16" diam. holes to set concrete piling for overpass supports. Tough soil conditions made complete pile driving impossible, but the problem was solved by preboring, driving only the last few feet. If you have a similar problem let us show you how to save time and money with the BUDA-HUBRON EARTH DRILL.

Sketch, above, shows a proved method of preboring for piles to secure better alignment, eliminating damage to piles, by using an Earth Drill. (Holes are clean cut—can be used as the form for cast-in-place piles.)

THE BUDA CO., Dept A, Harvey, (Chicago Suburb) Illinois

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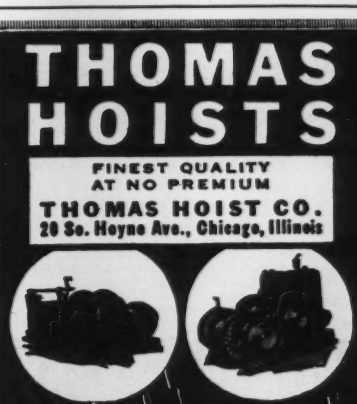
THOMAS HOIST CO.
26 So. Hoyne Ave., Chicago, Illinois



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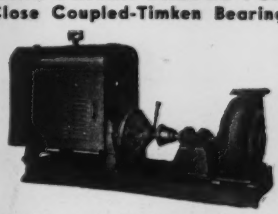

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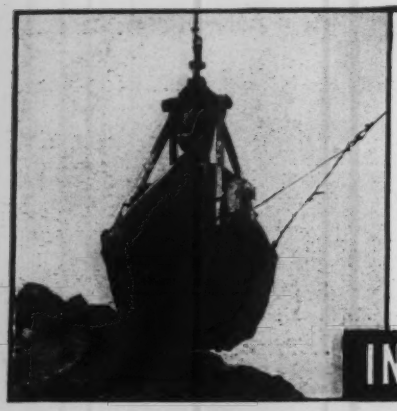

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Built in rope-reeve, power-wheel, lever-arm and link types, there is an Industrial Brownhoist clamshell bucket designed to best meet your specific handling needs. Durable, strong and easy to operate. Note how the rope-reeve bucket illustrated takes a full bite in the handling of red clay. Capacities from ½ to 15 yds. Write for catalog 353.

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Manufacturers' Activities

Allis-Chalmers Review

THE ALLIS-CHALMERS MFG. CO. of Milwaukee has released a 100-page comprehensive review of advancements and developments made by that firm in 1940 with a forecast of what lies ahead. Managers of the nine principal divisions of the company have written on the work of their section giving a clear, concise, but brief record of accomplishment. More than 200 illustrations are used to portray the work of the various divisions.

ALFRED W. THOMPSON was elected president, treasurer and general manager of the Ludlow Valve Mfg. Co., Inc., of Troy, N. Y., recently to succeed LIVINGSTON W. HOUSTON. ROBERT BISCHOFF, formerly associated with the Koppers Co., in a sales and engineering capacity, has been appointed sales manager.

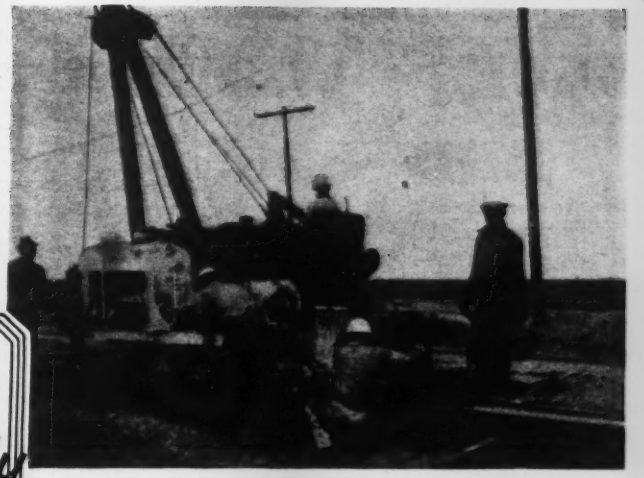
HAROLD F. FALK, former production manager of the Falk Corp., Milwaukee, has been appointed general superintendent to succeed his father, HAROLD S. FALK, who was elected president of the firm last year.

PIONEER ENGINEERING WORKS of Minneapolis, Minn., announce the promotion of Carl R. Rolf to assistant sales manager. Orval Ohnstad has been appointed district sales engineer for territory including the Dakotas, Minnesota, Wisconsin, Iowa, Nebraska, Kansas and Missouri.

THE BUDA CO. of Harvey, Ill., announces the opening of an office and display floor at 1469 Church St., Washington, D. C., under the direction of Col. H. H. Frost, vice president.

THE WOODS BROTHERS CONSTRUCTION CO., which has been located at Lincoln, Neb., for more than 50 years, has moved to Omaha. Franklin G. Floete is president of the company. This concern is one of the three contractors who are building the $10,000,000 bombing plant at Fort Crook, Neb., ten miles south of Omaha.

ANDREW HUTTON, recently chief engineer of the Davis Engineering Corp., Elizabeth, N. J., has just been appointed works manager of the Robins Conveying Belt Co. plant at Passaic, N. J., where he will be in charge of all manufacturing operations, buildings and equipment.



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REILLY Pipe Coatings Are TIME-TESTED

● The best laboratory in which protective pipe coatings can be tested is "Mother Earth" herself. No other test can possibly be so positive and assuring—and it is from examinations of pipe, coated with REILLY PRIMER AND PIPE ENAMEL, and installed many years ago, that our claims for these products are made. The ability of REILLY coatings to stand up under various conditions of soil—and under wide extremes of temperature variation; has been amply proved.

Ease and convenience of application and comparative low cost are other considerations which are responsible for the constantly growing preference for these products. Write for literature.

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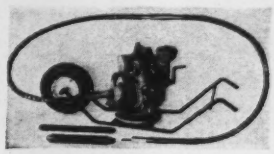

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Contractor: Corbetta Construction Co., New York;
Architect-Engineer: Victor Mayper, New York

JOB SCHEDULE

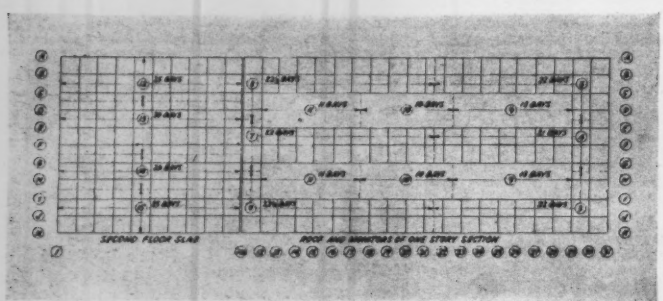
POUR NO.	LOCATION	NUMBER OF BAYS	EXCAVATION, FOUNDATIONS, GRADE	FORM	REINFORCING AND TRAPS	CONCRETE	STRIP	REUSE AT
1	1ST FL.	32½	SEPT. 21	SEPT. 23-24	SEPT. 25	SEPT. 27	SEPT. 30	3-4
2	1ST FL.	32½	" 23	" 25-26-27	" 26-27	OCT. 1	OCT. 2	4-5
3	ROOF	22	-	SEPT. 30 OCT. 1	OCT. 1-2	" 2	" 4	6
4	MONITOR	31	SEPT. 30	OCT. 1-2	" 2-3	" 3	" 7	7
5	ONE STORY BUILDING	22	OCT. 2	" 3	" 4	" 7	" 9	8
6		22½	" 3	" 4	" 7	" 8	" 10	9
7		22	" 5	" 7-8	" 8	" 9	" 11	9-10
8		22½	" 8	" 9	" 10	" 11	" 14	10-11
9	MONITOR	26	-	" 10	" 11	" 14	" 16	12
10		20	-	" 11	" 14	" 15	" 17	12-13
11		22	-	" 14-15	" 15	" 16	" 18	13
12	2ND FL.	25	OCT. 15	" 16	" 17	" 18	" 21	14
13		30	" 16	" 17-18	" 18-21	" 22	" 24	15-16
14		20	" 18	" 21	" 22-23	" 24	" 28	17
15	ROOF	28	" 22	" 24	" 25	" 28	" 30	18
16		18	-	" 25	" 28	" 29	" 31	19
17		32	-	" 28	" 29	" 30	NOV. 1	19
18		26	-	" 30	" 31	NOV. 4	" 6	-
19	MONITOR	24	-	OCT. 31 NOV. 1	NOV. 4	" 5	" 7	-

TWO STORY BLDG

FLOORS ON EARTH ONE STORY BLDG WK. END NOV. 1
ROOF " " 2-STORY " " " " 9

BASIS OF SCHEDULE:
FORMS ARE FURNISHED FOR 60 BAYS. 'INCOR' CEMENT TO BE USED, PERMITTING COMPLETE STRIPPING 2ND MORNING AFTER POUR. THE 60 BAYS ARE USED FOR 3 DAYS POUR WITHIN SAME CALENDAR WEEK. ALL BAYS FOR GIRDERS, BEAMS AND SLABS ARE COMPLETELY REUSABLE OVERNIGHT.

Utilizing 'Incor's 24-hour service strength and forming only 15% of the area, a carefully prepared progress schedule enabled Corbetta Construction Co., Inc., to complete this factory building in record time—at minimum cost. This job shows that form economies are possible on one- and two-story buildings as well as on multi-story structures.



Planning with 'Incor' Produces Top Speed at Minimum Cost

SPEED is the need of the hour. Good job planning and 'Incor' 24-Hour Cement save vital weeks and often reduce construction costs.

As a result of careful planning, Crawford Clothes factory, occupying an entire city block in Long Island City, New York, was completed in record time—at minimum cost.

Corbetta Construction Co., Inc., general contractors, estimated this one- and two-story building, of reinforced concrete beam-and-girder design, on the basis (1) of forming 50% of the required area, or (2) by using 'Incor' 24-Hour Cement and forming about 15% of the area. Either method meant a time saving of about 4 weeks over usual schedules. *But 'Incor' showed a net cost saving of $8255, as against the extra forms needed for the same construction speed.*

'Incor'* was used in the frame; elsewhere Lone Star was used. The job was completed in record time—faster speed at lower cost. Write for copy of "Cutting Concrete Costs." Lone Star Cement Corporation, Room 2281, 342 Madison Avenue, New York.

*Reg. U. S. Pat. Off.

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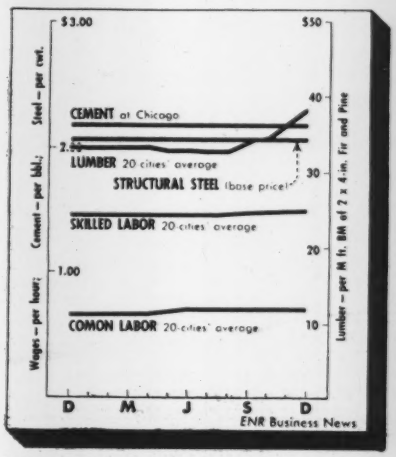
INTRODUCTION TO
CONSTRUCTION COSTS
1941 EDITION

HIGH CONSTRUCTION VOLUME begets high construction costs. If the relative stability of costs in 1939, when the increase in volume began, raised hopes that this economic law would this time prove false, they are now dashed on the rocks of reality. Construction costs in 1940 were the highest in 20 years, and the pressure is still upward. Insofar as the *ENR* Construction Cost Index is concerned, lumber and labor are responsible for its high level, cement and steel, the other components, remaining stable. That, in brief, is the construction cost picture that nine months of defense effort has put on display.

In retrospect, 1940 cost trends presented two distinct aspects. The opening five months were characterized by a continuation of the stability evident in 1939, but then began the gradual rise that brought the *ENR* Construction Cost Index for December to the highest level attained since December, 1920. An increase in the labor component of the index occasioned rises in May, June and July, which were partly offset by decreased lumber prices. But, then between August and December, the demand for lumber caused by the cantonment and defense building programs boosted the lumber component 17 percent, and another labor increase occurred in September. The combination of gains in these two important cost factors resulted in the 20-year peak of 249.12 being reached.

Current cost figures for the first four months of 1941 reveal a continuation of the rising trend. Lumber prices climbed in January and February, but this condition was apparently checked in March and April. Labor rates, after holding at year-end levels in the opening month have gained 2 percent since January.

Indications are that labor rates will continue to rise for at least another two months. Many contracts between labor and management expire within that period; some have already been renewed with higher rates to take effect when present contracts expire, and others now in the process of negotiation point toward increases for construction labor. Under these circumstances, it is evident that high costs will prevail during 1941.



Labor and material prices in 1940 that affected ENR Cost Indexes.

In a period of economic upheaval, such as that which we are experiencing at present, knowledge of costs and cost trends is more important than ever. For this reason, the guiding objective in the preparation of the following cost figures has been to present them in the most useful and usable form. No attempt has been made at interpretation, the collected data constituting a reference manual, not a series of cost discussions.

To aid in relating the following 70 pages of cost data to the complete construction picture, a brief summary of 1940 may be useful. The year's volume reached the highest peak ever reported. Public works, accounting for 71 percent of the $3,987,000,000 total, was also an all-time high; private engineering and large-scale residential construction topped all annual volumes since 1930. The record-breaking 1940 total exceeded the high of 1929 by 1 percent and rose 33 percent over 1939.

The measure of activity here is dollars. In view of the high cost levels that existed, physical volume of construction may be a better measure, and according to the *ENR* Volume Index, which is adjusted for cost changes, the physical gain over 1939 was 27 percent. However, a comparison with 1929 on the same basis shows a 15-percent decrease, despite the 1-percent gain in dollar volume.

To get back to costs, the *ENR* Construction Cost Index averaged 241.96 for 1940, a 2.7-percent increase over 1939, and the top annual figure reported since 1920. The *ENR* Building Cost Index, in which a skilled labor component is substituted for the common labor in the Construction Cost Index, averaged 202.81 and also exceeded the 1939 mark by 2.7 percent. A 10-month period of stable costs preceded its first important rise in September. This index climbed from 201.71 in August, just before the increase, to 208.19 in December, a 3.2-percent gain.

Construction wage averages for common labor rose to a new high of 69.9c. per hour for 1940, an increase of 2.3 percent over the preceding year. The *ENR* 20-cities average rate for skilled labor, $1.473, also a new record, was 2.1 percent above 1939.

Construction material prices, with the exception of lumber, remained fairly steady during 1940. Long leaf yellow pine in New York was up 5 percent over the 1939 average; common brick rose 0.3 percent; while portland cement in New York and the base price for structural steel shapes held at last year's levels.

A quick picture of the current scene shows the construction dollar volume 128 percent higher than in the first quarter of 1940; private awards up 81 percent; public construction ahead by 151 percent as a result of an 878 percent gain in federal work, largely for defense. The *ENR* Construction Cost Index for April is 1.1 percent above the January figure, and up 5.9 percent compared with April, 1940, with the factors noted above responsible. With lumber price rises apparently checked, and with steel and cement unchanged, the possibility for further rises in costs rests largely on construction labor.

ENR Construction Cost Index

THE ENGINEERING NEWS-RECORD Construction Cost Index has four components: (1) structural steel shapes, base price; (2) cement at Chicago; (3) lumber, which until 1935 was 12 x 12 long leaf yellow pine wholesale at New York, and since 1935 is 2 x 4 S4S pine and fir in carload lots, *ENR* 20-cities average; (4) common labor, *ENR* 20-cities average of wage rates in force.

The weighting for the original price series is given in the following computation for December, 1934:

Steel	25 cwt. x 1.80	= 45.00
Lumber	0.6 x 61.00	= 36.60
Cement	6 x 2.00	= 12.00
Labor	200 x .5413	= 108.26
Index		201.86

The weighting for the new lumber price series is 1.088, and the computation for January, 1941 index is:

Steel	25 cwt. x 2.0675	= 51.69
Lumber	1.088 x 39.20½	= 42.66
Cement	6 x 2.19	= 13.14
Labor	200 x .711	= 142.20
Index		249.69

This Construction Cost Index is designed to predict changes in construction cost trends and to measure the movement of construction costs in general. It is not intended to apply to any specific class of construction or to a particular locality.

ENR Building Cost Index

In practice, the construction cost index has been used widely to apply

Engineering News-Record BUILDING Cost Index—1913 = 100

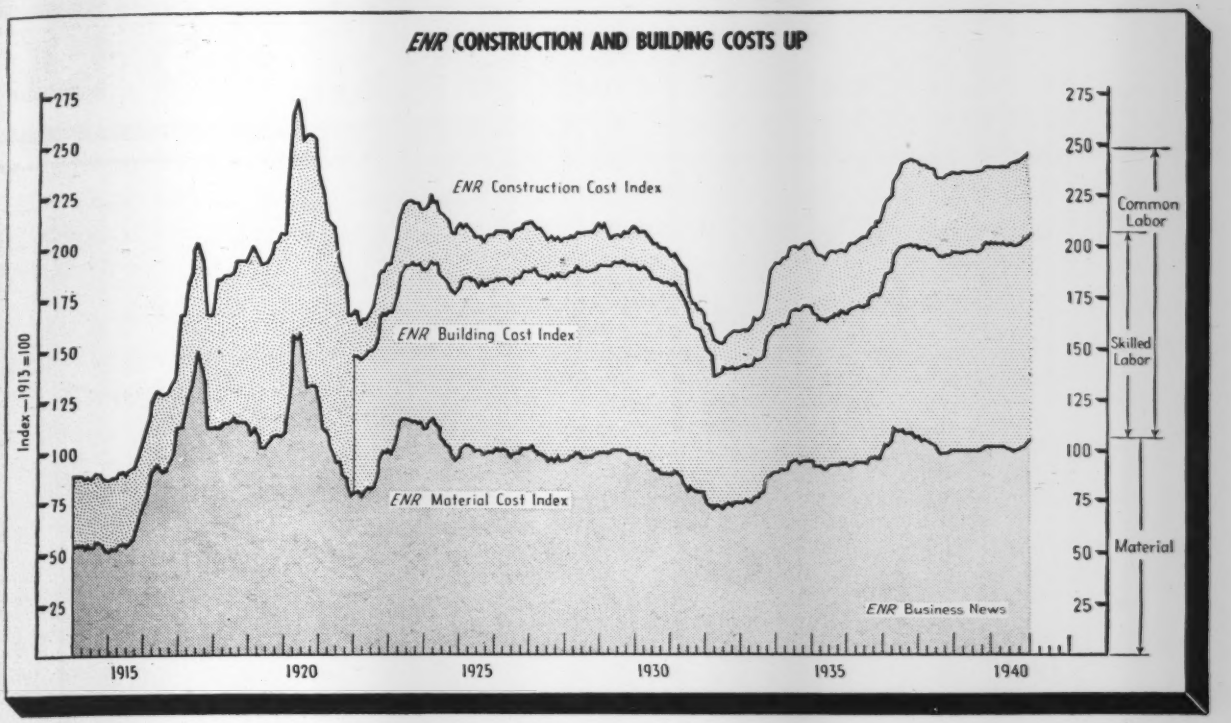
Yearly Aver. prior to 1922			1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935†	1936†	1937†	1938†	1939†	1940†	1941†
1910....	96.4	J	147.1	168.2	189.3	182.7	184.3	187.8	185.9	190.0	190.3	180.7	150.6	140.8	160.2	166.5	168.3	185.5	198.6	196.2	201.5	207.9
1911....	94.1	F	146.5	172.6	191.7	184.5	183.7	189.2	187.2	190.0	188.5	182.0	147.2	141.7	161.3	165.8	168.4	186.6	199.0	196.2	201.5	208.4
1912....	91.4	M	145.2	178.4	194.1	184.5	184.3	187.3	187.2	190.0	189.2	180.2	145.9	140.8	161.7	164.1	169.7	187.7	199.3	196.5	201.5	207.9
1913....	100.0	A	147.1	186.0	191.8	184.7	184.1	186.0	188.8	190.0	188.8	177.6	135.7	141.5	163.2	164.4	170.0	195.0	198.2	196.5	201.4	208.6
1914....	91.9	M	149.0	188.9	192.5	182.8	183.6	185.4	190.1	191.3	187.9	174.6	136.4	143.9	168.2	163.3	170.3	197.2	197.9	196.6	201.2	.....
1915....	95.3	J	149.8	191.3	187.7	183.0	181.8	185.8	187.6	192.0	185.4	172.5	137.6	143.2	168.2	164.9	170.2	199.2	198.2	196.4	201.7	.....
1916....	130.9	J	150.9	191.4	184.5	180.2	184.3	183.9	187.6	192.0	183.3	170.5	139.5	144.3	169.2	165.3	170.9	199.8	194.4	196.8	201.7	.....
1917....	166.8	A	154.6	191.5	183.3	183.0	185.1	186.5	187.6	192.8	183.7	163.1	139.4	145.9	168.4	166.2	173.9	200.7	194.5	196.5	201.7	.....
1918....	159.1	S	164.2	192.2	181.4	180.5	185.1	184.6	187.6	191.6	182.4	159.5	139.6	154.5	170.1	166.1	174.3	200.6	194.8	196.6	203.1	.....
1919....	158.8	O	167.8	191.0	178.4	181.8	188.0	186.6	187.6	190.3	181.8	159.5	140.0	157.1	170.2	167.3	175.3	201.0	195.5	198.5	204.0	.....
1920....	207.2	N	167.1	192.4	176.5	182.4	188.0	185.0	188.0	190.3	181.8	158.3	139.5	159.0	170.2	167.3	175.5	200.3	195.6	201.2	206.2	.....
1921....	166.1	D	169.1	188.0	178.4	183.1	188.0	185.1	190.0	190.3	181.8	155.0	140.0	160.7	170.2	167.2	179.3	200.5	196.1	201.2	208.2	.....
		Aver.	154.9	186.0	185.8	182.7	185.0	186.1	188.0	190.9	185.4	169.4	140.9	147.8	166.7	165.8	172.2	196.2	196.8	197.4	202.8	.....

Engineering News-Record CONSTRUCTION Cost Index—1913 = 100

Yearly averages prior to 1914			1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
		J	89.22	87.12	112.66	167.75	184.51	198.05	206.55	237.08	168.72	191.70	217.90	210.40	207.15	211.50	203.90	209.40	208.96
1903.....	93.90	F	89.22	87.36	116.66	167.75	184.51	201.50	225.10	230.67	168.72	197.40	220.30	209.70	206.55	210.15	204.65	210.40	206.46
1904.....	87.40	M	88.97	87.66	125.16	175.66	184.51	198.05	240.85	224.27	162.04	205.25	224.70	210.20	207.65	208.80	204.65	207.78	206.80
1905.....	90.55	A	87.97	90.16	129.51	183.41	186.01	191.25	265.20	213.07	164.72	213.50	221.60	209.55	207.05	209.00	206.40	203.40	207.12
1906.....	95.10	M	88.62	90.16	131.06	187.61	186.01	191.25	268.90	210.82	164.62	216.70	222.38	207.20	207.30	206.80	207.00	205.15	205.86
1907.....	100.55	J	87.87	88.96	128.71	199.26	186.31	191.85	273.80	209.82	166.62	220.70	216.85	204.60	204.80	205.55	206.15	205.65	203.36
1908.....	97.20	J	88.12	90.51	127.96	204.01	188.65	193.65	265.65	203.82	169.70	222.10	214.40	204.60	207.80	203.68	206.65	204.77	200.95
1909.....	90.92	A	90.11	91.76	128.76	198.41	193.85	196.65	252.00	193.47	173.40	221.50	213.15	204.60	208.30	205.50	207.29	205.91	200.95
1910.....	96.33	S	90.36	93.01	131.76	190.31	193.85	202.85	255.20	188.27	185.00	221.50	211.25	202.10	208.30	203.60	207.29	207.57	199.58
1911.....	93.43	O	88.51	96.16	135.11	167.11	193.85	202.25	255.20	182.57	188.60	220.30	207.55	205.35	209.80	204.40	207.71	206.32	198.72
1912.....	90.70	N	87.26	101.06	138.16	166.51	193.55	206.85	255.32	166.32	188.60	220.90	205.70	205.95	210.80	201.98	209.46	208.46	198.54
1913.....	100.00	D	86.51	107.06	149.41	167.11	194.75	206.85	251.62	167.82	192.60	217.30	208.58	205.95	210.80	203.90	210.16	209.46	196.86
		Aver.	88.56	92.58	129.58	181.24	189.20	198.42	251.28	201.81	174.45	214.07	215.36	206.68	208.03	206.24	206.78	207.02	202.85

Engineering News-Record CONSTRUCTION Cost Index—1926 = 100

Yearly averages prior to 1914			1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
	1926 = 100	J	42.9	41.9	54.2	80.6	88.7	95.2	99.3	110.0	81.1	92.2	104.7	101.1	99.6	101.7	98.0	100.6	100.4
		F	42.9	42.0	56.1	80.6	88.7	96.9	108.2	110.9	81.1	94.9	105.9	100.8	99.3	101.0	98.4	101.1	99.2
1903.....	45	M	42.8	42.1	60.3	84.4	88.7	95.2	115.8	107.8	77.9	98.7	108.0	101.0	99.8	100.3	98.4	99.9	99.3
1904.....	42	A	42.2	43.3	62.0	88.2	89.5	91.9	127.5	102.4	79.2	102.6	106.5	100.7	99.5	100.4	99.2	97.8	99.6
1905.....	43.5	M	42.6	43.3	63.0	90.2	89.5	91.9	129.3	101.3	79.1	104.2	106.9	99.6	99.7	99.4	99.6	98.6	99.0
1906.....	46	J	42.2	42.7	61.9	95.8	89.5	92.2	131.6	100.9	80.1	106.1	104.3	98.4	98.5	98.8	99.1	98.9	97.8
1907.....	51	J	42.4	43.5	61.5	98.1	90.7	93.1	127.6	98.0	81.6	106.8	103.1	98.4	99.9	97.9	99.3	98.4	96.6
1908.....	47	A	43.3	44.1	62.0	95.4	93.2	94.5	121.1	93.0	83.4	106.5	102.4	98.4	100.1	98.8	99.6	99.0	96.6
1909.....	44	S	43.4	45.1	63.3	91.5	93.2	97.5	122.7	90.5	88.9	106.5	101.5	97.1	100.1	97.9	99.6	99.8	95.9
1910.....	46	O	42.5	46.2	64.8	80.3	93.2	97.2	122.7	87.8	90.7	105.9	99.8	98.7	100.9	98.3	99.8	99.2	95.5
1911.....	45	N	41.9	48.4	66.4	80.0	93.0	99.4	122.7	80.0	90.7	106.2	98.9	99.0	101.3	97.1	100.7	100.2	95.4
1912.....	43.5	D	41.1	51.4	71.8	80.3	93.6	99.4	121.0	80.6	92.6	104.5	100.2	99.0	101.3	98.0	101.0	100.7	94.6
1913.....	48																		
		Aver.	42.5	44.5	62.2	87.1	90.9	95.3	120.8	97.0	83.8	102.9	103.5	99.4	100.0	99.1	99.4	99.5	97.5



to building costs, and when common and skilled labor rates move in similar trends it is a satisfactory measure of relative building cost movement. However, following the low wage rates of 1932, common labor climbed much faster than skilled and reached new all-time highs by July, 1937. The increase was in the lower ranges between union and non-union. When "prevailing" wages became synonymous with union wages the gap closed up, hence the *ENR* 20-cities wage average increased more rapidly than the union rates.

To provide a more representative measure of building cost movement, the skilled labor trend has been substituted for the common labor trend in the *ENR* Construction Cost index, and the *ENR* Building Cost index computed. The labor weighting applied to the *ENR* skilled labor average for 20-cities thus becomes 68.38 hr., and the computation for the Jan. 1941 Building Cost Index is:

Steel	25 cwt. x 2.0675 =	51.69
Lumber	1.088 x 39.20¼ =	42.66
Cement	6 x 2.19 =	13.14
Labor	68.38 x 1.469 =	100.45
Index		207.94

* Superseded by figures in last seven columns using 2 x 4 fir and pine lumber component.
† Based on 2 x 4 S4S Fir and pine *ENR* 20 cities average lumber component instead of 12 x 12 yellow pine wholesale in New York used prior to 1935. For explanation see page C-5 of June 30, 1938 *ENR*.

CONSTRUCTION Cost Index—1913 = 100

1931	1932	1933	1934	1935*	1936*	1937*	1935†	1936†	1937†	1938†	1939†	1940†	1941†	
194.48	162.48	158.44	191.26	198.72	199.48	223.45	198.22	201.23	221.20	239.62	234.72	238.34	249.69	J
196.61	161.82	159.30	194.06	196.02	201.20	223.45	195.07	201.33	222.05	238.99	234.31	238.32	250.50	F
194.51	157.24	158.44	194.06	194.26	201.20	225.25	194.41	201.63	224.75	238.79	234.43	238.29	250.71	M
191.63	153.12	160.16	195.86	194.50	202.20	230.25	194.65	202.80	231.35	237.95	234.86	238.26	252.40	A
189.33	152.78	164.39	199.61	194.06	203.40	233.25	193.96	204.05	233.45	236.80	234.69	238.86	.....	M
187.23	152.20	163.41	199.61	194.78	204.60	238.15	196.73	205.08	237.25	236.86	235.02	241.59	.....	J
174.37	153.36	165.50	199.65	195.18	204.40	241.75	197.43	204.80	239.90	232.29	234.94	242.15	.....	J
171.38	156.80	167.00	198.40	195.10	208.10	242.95	197.45	208.48	240.65	232.39	234.90	242.18	.....	A
171.40	157.96	175.48	200.58	195.10	208.10	243.95	197.30	208.88	241.62	232.70	234.97	244.13	.....	S
169.78	159.16	187.74	200.86	195.10	211.50	244.55	197.50	211.53	241.90	234.30	236.86	245.02	.....	O
169.28	158.20	190.14	201.36	194.90	212.70	244.95	197.35	211.50	241.40	234.40	238.20	247.24	.....	N
166.23	158.46	192.14	201.86	194.90	220.05	244.95	197.20	215.70	241.05	234.89	238.17	249.12	.....	D
181.35	156.97	170.18	198.10	195.22	206.41	236.41	196.44	206.42	234.71	235.86	235.51	241.96	.....	Aver.

CONSTRUCTION Cost Index—1926 = 100

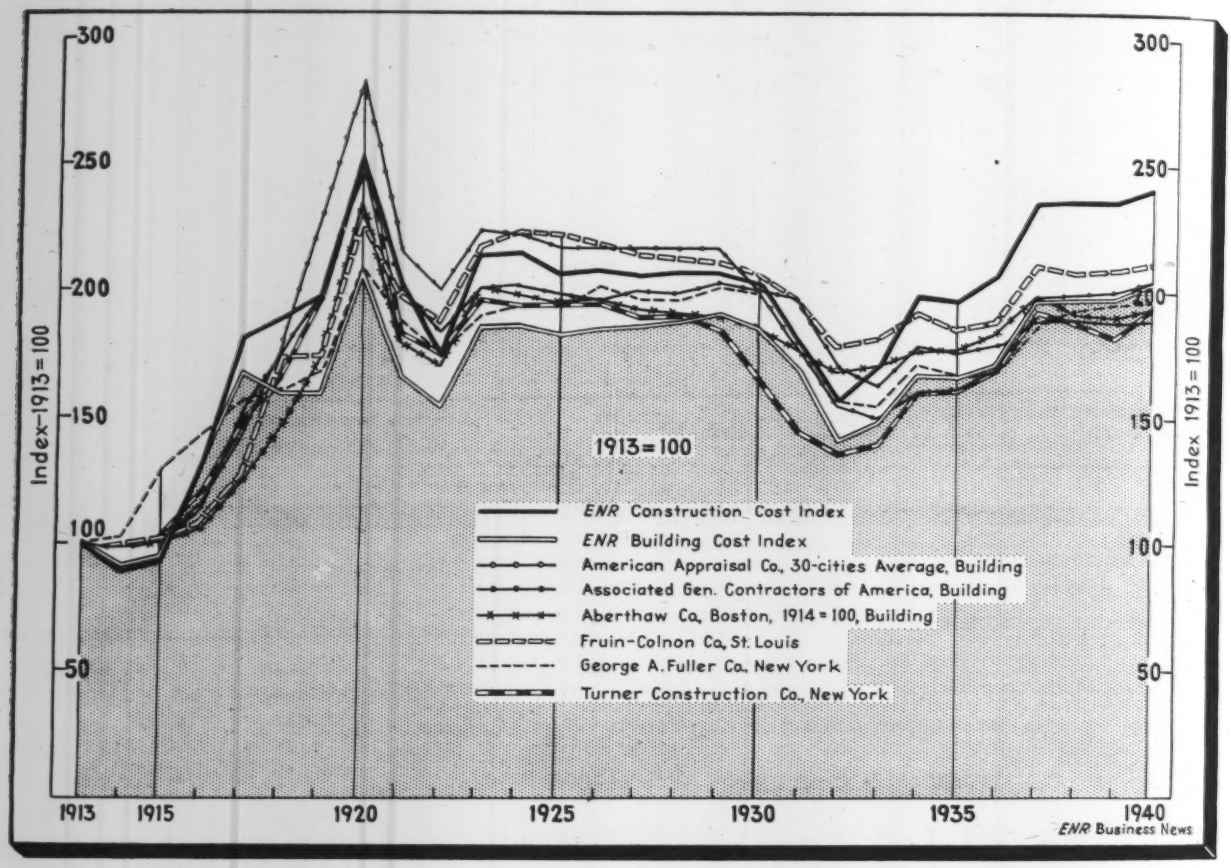
1931	1932	1933	1934	1935*	1936*	1937*	1935†	1936†	1937†	1938†	1939†	1940†	1941†	
93.5	78.1	76.2	91.9	95.5	95.9	107.41	95.3	96.7	106.2	114.9	112.9	114.6	120.0	J
94.5	77.8	76.6	93.3	94.2	96.7	107.41	93.8	96.8	106.7	114.9	112.7	114.6	120.4	F
93.5	75.6	76.2	93.3	93.4	96.7	108.18	93.5	96.9	108.0	114.8	112.7	114.6	120.5	M
92.1	73.6	77.0	94.1	93.5	97.2	110.64	93.5	97.5	111.2	114.4	112.9	114.5	121.3	A
91.0	73.4	79.0	95.9	93.3	97.8	112.08	93.2	98.2	112.0	113.8	112.8	114.8	.....	M
90.0	73.2	78.5	95.9	93.6	98.4	114.48	94.6	98.5	113.8	113.9	113.0	116.1	.....	J
83.8	73.7	79.6	96.0	93.8	98.3	116.21	94.9	98.4	115.1	111.7	112.9	116.4	.....	J
82.4	75.4	80.3	95.4	93.8	100.0	116.78	94.9	100.2	115.7	111.7	112.9	116.4	.....	A
82.4	75.9	84.4	96.4	93.8	100.0	117.27	94.9	100.4	115.9	111.9	113.0	117.4	.....	S
81.6	76.5	90.2	96.6	93.8	101.7	117.55	95.0	101.5	116.1	112.7	113.9	117.8	.....	O
81.4	76.0	91.4	96.8	93.7	102.2	117.75	94.9	101.5	115.8	112.7	114.5	118.9	.....	N
79.9	76.2	92.4	97.0	93.7	105.8	117.75	94.8	103.4	115.7	112.9	114.5	119.8	.....	D
87.1	75.4	81.8	95.2	93.8	99.2	113.63	94.4	99.2	112.7	113.3	113.2	116.3	.....	Aver.

Base Conversion Table

To convert *ENR* Construction and Building Cost Indexes

From 1913 = 100 Base To	Divide 1913 = 100 Values By Const. Cost	 Bldg. Index
1926 = 100	2.0803	1.8499
1929 = 100	2.0702	1.9086
1910–14 = 100	.9380	.9477
1924 = 100	2.1536	1.8578
1923–25 = 100	2.1204	1.8481
1914 = 100	.8856	.9191
1911 = 100	.9343	.9414

Special Building Cost Indexes



New American Appraisal Company Construction Cost Trend Index — 1913 = 100

For average of four types of buildings: All Frame, Brick Wood Frame, Brick Steel Frame and Reinforced Concrete.

These indices cover structural items only, and do not include factors for Plumbing, Heating, Lighting, Elevators, etc.

	1914	'15	'16	'17	'18	'19	'20	'21	'22	'23	'24	'25	'26	'27	'28	'29	'30	'31	'32	'33	'34	'35	'36	'37	'38	'39	'40
U. S. AVERAGE 1913 to 1924 — 24 Cities 1925 to 1939 — 30 Cities	98	101	116	143	177	229	283	216	200	224	222	217	217	217	217	217	200	178	155	150	161	162	170	198	199	200	204
Boston	100	103	118	149	183	234	288	220	209	232	229	224	224	222	222	224	212	195	169	163	170	169	178	212	209	210	214
New York	99	100	115	142	175	227	299	245	219	245	241	230	234	234	235	237	219	201	170	167	176	174	182	213	216	219	223
Buffalo	98	99	115	144	180	232	278	214	197	228	225	218	219	217	213	212	195	178	157	150	160	158	165	202	206	205	207
Baltimore	97	99	116	150	193	239	289	215	206	233	229	226	224	226	227	228	211	186	166	158	167	173	180	200	200	198	200
Philadelphia	98	102	115	145	181	236	300	220	201	232	230	224	225	228	227	227	209	190	161	156	166	166	171	193	194	196	207
Pittsburgh	97	99	115	142	179	231	290	221	201	228	238	233	236	237	236	236	217	198	172	161	170	168	177	211	219	219	219
Cincinnati	99	100	115	143	173	217	276	211	194	221	221	219	217	219	219	220	202	176	157	151	161	162	174	206	209	209	213
Cleveland	97	99	120	149	179	233	303	227	210	241	243	236	233	231	232	232	213	188	160	151	164	168	175	208	207	206	209
Chicago	97	100	116	141	170	224	294	226	202	228	225	224	219	222	222	222	205	185	162	156	166	169	179	204	205	205	207
Indianapolis	102	104	119	146	175	221	279	221	202	225	227	222	219	222	224	224	206	182	157	150	161	161	169	199	204	205	209
Detroit	99	102	122	150	187	244	304	220	200	229	227	226	224	222	221	220	202	174	148	146	157	160	168	203	205	207	212
Milwaukee	100	103	120	150	178	237	290	212	195	224	224	217	218	219	220	218	197	163	144	141	156	163	178	208	208	209	213
Minneapolis	98	100	114	142	171	218	277	210	193	214	208	201	197	197	197	198	182	165	148	146	154	154	162	199	201	202	203
Kansas City	98	102	120	150	184	239	280	220	211	231	228	220	220	215	213	213	193	178	156	149	160	162	169	202	209	209	211
St. Louis	97	100	114	141	175	228	284	225	204	228	238	233	230	226	225	224	205	188	163	156	166	164	171	207	207	207	211
Atlanta	97	98	111	140	186	250	304	218	202	226	217	209	211	214	215	215	195	173	147	142	162	163	170	192	185	187	193
Dallas	100	105	121	145	176	227	274	209	191	209	206	198	204	204	202	202	187	168	146	139	149	148	154	170	168	171	173
New Orleans	97	96	113	136	174	239	282	217	201	225	227	216	217	218	215	215	198	170	145	141	159	159	166	186	187	194	202
Denver	100	102	118	145	171	216	262	206	191	202	206	204	204	202	205	207	189	168	149	141	150	151	157	190	193	195	199
Seattle	96	101	115	141	176	224	268	197	186	207	206	201	199	195	194	198	184	159	141	136	150	154	161	194	193	195	200
San Francisco	97	104	118	139	169	214	258	204	189	208	199	194	188	188	188	190	177	158	144	138	148	144	155	178	176	180	181
Los Angeles	97	102	112	133	162	213	251	208	199	213	204	197	195	193	193	196	178	157	141	134	142	140	143	165	166	167	166

NOTE — These construction cost index figures are based on 1913 as 100% for each individual location, thus indicating the trend in each city and not the trend between the various locations. The index figures are calculated on the basis of normal average material prices, average labor wages, and the market conditions in the individual cities and do not reflect extremes such as premium prices and overtime wages for rush work during boom periods or the "extreme low" of cut-throat practices during the "depression periods."

12 Cost-Cutting Features . . .

REASONS WHY KINNEAR DOORS HAVE BEEN PREFERRED BY ARCHITECTS, ENGINEERS AND BUILDING OWNERS FOR ALMOST A HALF-CENTURY!

1. THEY SAVE SPACE! Kinnear Rolling Doors coil into a small space above the opening. They require no usable floor or wall space, either for storage or operation.
2. THEY ARE FIRE RESISTIVE! You get valuable extra protection against fire in the rugged all-steel curtain.
3. THEY PROTECT AGAINST THE ELEMENTS! The all-steel curtain is heavily galvanized for thorough, lasting protection against rust, weather and corrosion.
4. THEY ARE BARRIERS AGAINST THEFT! When Kinnear Rolling Doors are closed and locked, they barricade openings against intrusion with a curtain of steel
5. THEY FLEX UNDER IMPACT! The strong, steel-slat curtain affords a degree of flexibility . . . it absorbs blows that damage other types of doors.
6. THEY ARE MORE DURABLE! Actual service records show that many Kinnear Rolling Doors have been in continuous daily use for 20, 30, and even 40 years!
7. ACCIDENTAL DAMAGE IS EASILY REPAIRED! In case of damage any required number of slats can be replaced — quickly, easily and economically. Maintenance costs are always low!
8. OUT OF THE WAY OF DAMAGE! Kinnear Rolling Doors open out of reach of damage by wind, weather, trucks or other vehicles. A BIG saving in repair costs!
9. CONVENIENT AS A WINDOW SHADE! Counterbalanced for greatest ease, speed and smoothness of operation, Kinnear Rolling Doors save valuable time and labor. And they avoid all ground obstructions in opening!
10. THEY PROVIDE MORE STORAGE ROOM! Almost every square inch of surrounding floor, wall and ceiling space — and all exterior space — remains completely clear and usable!
11. ATTRACTIVE! The neat, straight-line design of the Kinnear Rolling Door's steel-slat curtain harmonizes perfectly with any architectural treatment. The standard door fills every requirement!
12. PRACTICAL FOR LARGE OPENINGS! Even on the largest doorways you can be sure of providing all the advantages of the Kinnear Rolling Door's SMOOTH, easy, economical and dependable operation!

AND A COMPLETE NATIONWIDE SERVICE

You avoid all door problems when you specify or install Kinnear Doors! That's because Kinnear sees to it that you get **accurate** estimates and **correct** working drawings—and get them promptly! You have available the full cooperation of trained Kinnear installation crews, to relieve you of responsibility and to insure speedy, accurate door installation. And there is always a Kinnear representative nearby to give you prompt service at any time! Take advantage of this valuable door service . . . write for complete details today, or submit your door requirements for recommendations!

THE KINNEAR MFG. CO.
1820-40 FIELDS AVE., COLUMBUS, O.
Offices and Agents in Principal Cities

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KINNEAR ROLLING DOORS

Construction and Building Cost Indexes—1913 through 1940

Year	AAC (Old)	AAC (New)	AGC	ENR Bldg.	ENR Const.	Boeckh New York	Handy R. C. Atl. Seab'd.	ICC-RR Sta. & Off. Bldg.	Aber-thaw	Austin Co.	Fruin-Colnon	Fuller	Tilgh-man Moyer	Turner
Base = 100	1913	1913	1913	1913	1913	1913	1911-'14	1910-'14	1914	1913	1913	1913	1913	1913
1913	100	100	100	100	100	100	...	...	...	100	100	100	100	100
1914	98	98	99	92	89	102	...	...	100	105	100	102	92	100
1915	101	101	100	95	93	99	...	101	100	115	102	130	96	103
1916	116	116	114	131	130	116	153	115	107	141	108	143	115	120
1917	144	143	152	167	181	135	233	135	126	172	128	156	142	147
1918	172	177	175	159	189	155	242	154	147	206	173	160	148	166
1919	213	229	198	159	198	171	237	185	172	198	174	168	190	196
1920	270	283	247	207	251	230	260	215	234	241	227	209	258	252
1921	205	216	200	166	202	193	207	192	179	180	197	188	210	183
1922	189	200	184	155	174	187	165	180	170	157	188	175	177	175
1923	212	224	201	186	214	215	199	194	202	181	217	190	214	196
1924	210	222	202	186	215	215	226	193	198	181	223	194	212	194
1925	203	217	199	183	207	211	219	188	195	185	222	193	209	195
1926	206	217	197	185	208	230	213	184	197	185	218	202	207	195
1927	206	217	200	186	206	223	208	189	193	178	214	197	202	190
1928	205	217	199	188	207	238	205	188	191	172	213	196	204	190
1929	206	217	203	191	207	242	211	187	190	170	211	201	208	185
1930	199	200	200	185	203	238	200	182	186	155	207	199	196	165
1931	171	178	196	169	181	230	184	165	176	131	196	180	170	145
1932	152	155	171	141	157	208	165	141	168	117	178	157	150	136
1933	146	150	163	148	170	197	159	145	170	117	181	155	152	140
1934	157	161	178	167	198	209	186	151	176	128	191	171	163	160
1935	157	162	176	166	196	200	190	151	177	139	185	167	178	162
1936	163	170	179	172	206	205	192	157	184	150	188	168	188	169
1937	181	198	188	196	235	226	208	166	199	165	210	187	214	192
1938	182	199	189	197	236	243	210	166	191	161	207	192	221	188
1939	183	200	188	197	236	248	206	166	190	152	208	195	229	182
1940	...	204	189	203	242	251	210	...	193	163	211	196	231½	193

Descriptions of Leading Building and Construction Cost Indexes

AMERICAN APPRAISAL COMPANY (AAC)—Average for 30 cities of four types of buildings: wood frame, brick-wood frame, brick-steel frame, reinforced concrete. Mechanicals not included. Based on actual appraisal costs. Available for individual cities (see page 102). Recently revised to include adjustments for social security taxes, unemployment insurance and corresponding "overhead". Base: 1913=100.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA (AGC)—Wages and materials for 12 cities combined in 40-60 ratio. Wages, prevailing rates for hod carriers and common labor. Materials, weighted: sand, gravel and crushed stone, 1; cement, 1; lumber, 1; hollow tile, ½; structural and reinforcing steel, ½. Base: 1913=100.

ENGINEERING NEWS-RECORD BUILDING COST (ENR Bldg.)—For complete description see pages 100 and 101.

ENGINEERING NEWS-RECORD CONSTRUCTION COST (ENR Const.)—For complete description see pages 100 and 101

E. H. BOECKH & ASSOC., INC.—Individual series for ten types of buildings for sixteen areas. (See page 114.) Weights based on studies of actual building costs—vary with different type of structures. Labor efficiency correction used. Material prices from local building trade papers. Prevailing skilled and common wage rates from contractors. Base: United States average, 1926-29=100. Series given here is brick and concrete, New York, converted to 1913=100 base.

HANDY PUBLIC UTILITY CONSTRUCTION COST—Compiled and published Jan. 1 and July 1 of each year by Whitman, Requardt & Smith. (See page 108.) Individual series for 81 cost elements in three classes of utility construction, for five geographic divisions of United States.

Weighting based on wide experience in cost analysis of plant and construction. Material prices from Engineering News-Record and Iron Age. Labor cost trends from U. S. Dept. of Labor and National Association of Builders Exchanges. Base 1911-14=100. The reinforced concrete building construction series is tabulated in this table.

RAILROAD CONSTRUCTION INDEX (ICC-RR)—Compiled by Engineering Section, Bureau of Valuation, Interstate Commerce Commission. (See page 106). Indexes for road (47 subseries), equipment (8 subseries), and general expenditures (7 subseries), for national average and 8 regional areas. Series quoted here is road, subseries 16, station and office buildings, national average. Computed from analysis of contracts covering major construction projects over 30-year period, and other information furnished by carriers. Base: 1910-14=100.

ABERTHAW—New England, seven-story and basement (62'4"x202'4"), reinforced concrete building built in 1914, repriced quarterly as a construction bid to duplicate original building. Labor costs based on current experience with similar construction. Base: 1914=100.

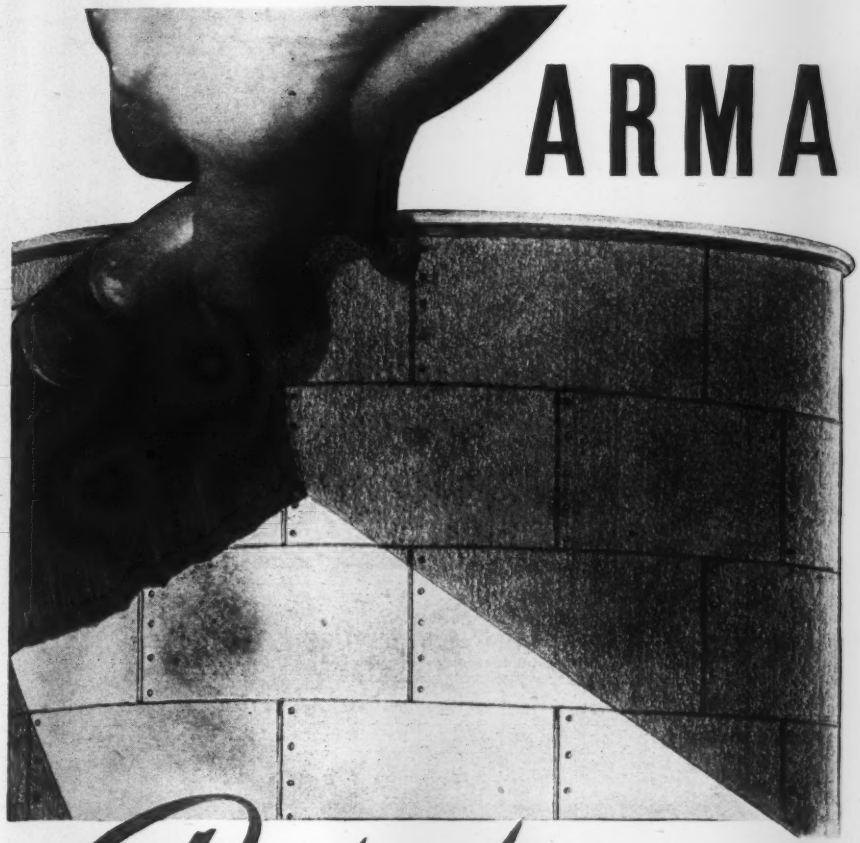
AUSTIN INDUSTRIAL BUILDING COST—Repricing typical one-story, steel frame, monitor type industrial building at regular intervals. Structure has concrete foundations, curtain walls of brick and large areas of steel sash and glass; concrete floor laid on ground; 2-in. lumber roof deck on heavy timber covered with 4-ply waterproofing. Monitor sash equipped with mechanical operators. Pricing at representative points in central and eastern states. Base: 1926=100. Series in table converted to 1913=100 base.

FRUIN-COLNON—Industrial plant of five buildings in St. Louis repriced on basis of contractor's actual and estimated material and labor costs. Base: 1913=100.

GEORGE A. FULLER COMPANY—Composite of 36 major cost elements, in three commercial type buildings, including mechanicals, elevators, wiring, heating and ventilating, repriced. Base 1913=100.

TILGHMAN MOYER COMPANY—Compiled monthly from actual cost records in construction of bank buildings in eastern United States. Includes all typical building items, and, in addition, all fixtures which are special in bank work, which in many cases exceed structural costs. Index reflects saving occasioned by use of reconditioned equipment from closed banks. Base: 1913=100.

TURNER CONSTRUCTION COMPANY—Eastern cities. Own building cost experience applied to these factors: labor rates, material prices, productivity of labor, efficiency of plant and management, competitive conditions. Base: 1913=100.



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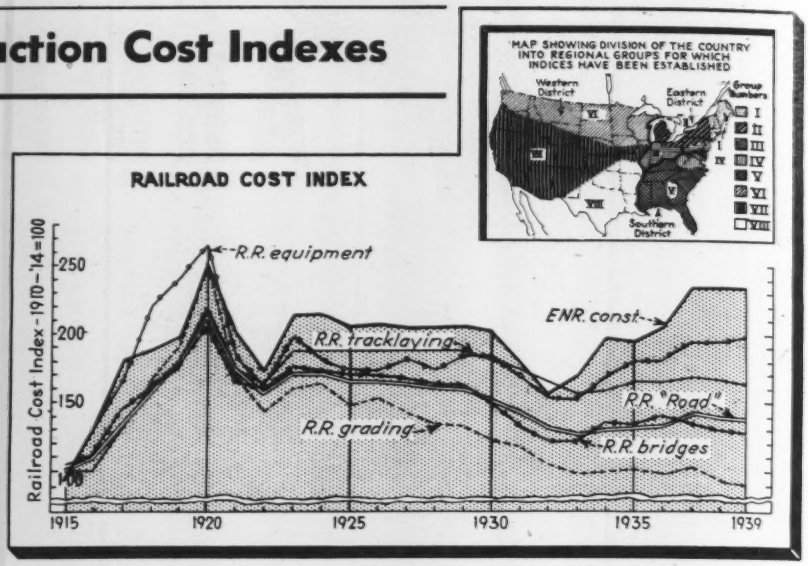
Railroad Construction Cost Indexes

THESE INDEXES by Engineering Section, Bureau of Valuation, Interstate Commerce Commission, include items developed from analysis of major construction contracts over a period of 30 years. Indexes for material accounts are based on studies of carriers' returns to Valuation Order 14, joint studies made with various sub-committees of Presidents' Conference Committee, well-known engineering and trade publications, contracts covering major construction projects over a period of 30 years, and other information furnished by individual carriers.



Railroad Cost Indexes for Regions by Years for "Road" Construction — 1910-14 = 100

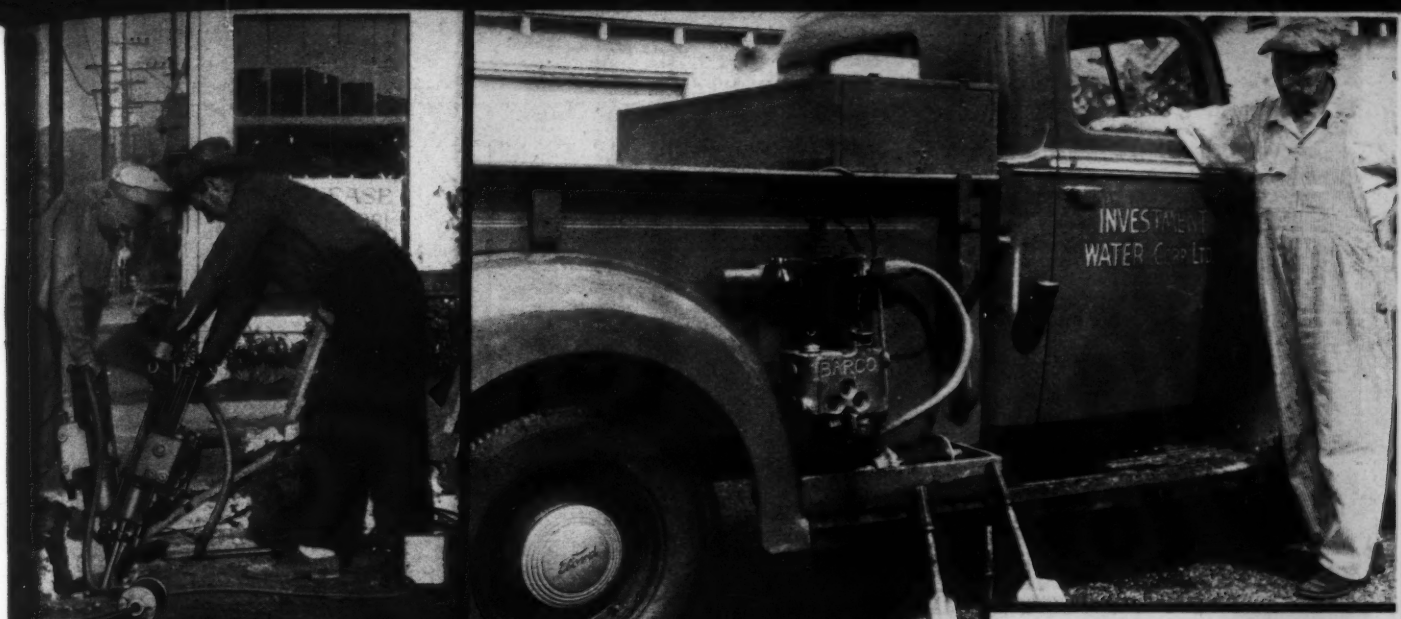
Total of Accounts 1-46, ROAD, Engineering Section, Bureau of Valuation, Interstate Commerce Commission, August 1, 1940

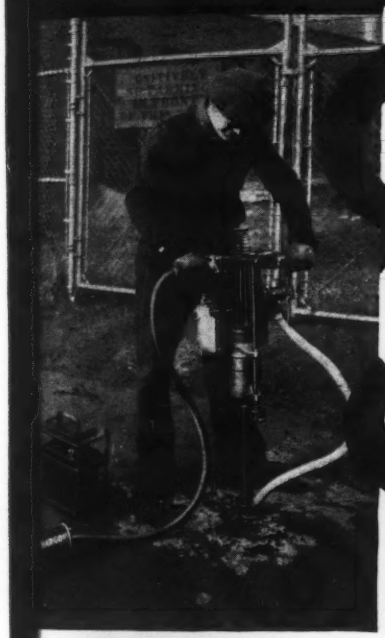
United States	Per Cent	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
Reg. I to VIII	73.09	134	159	178	214	175	157	171	171	166	166	164	161	160	152	143	131	127	131	131	133	142	138	137
Reg. I	75.36	138	162	184	220	178	163	177	178	172	173	171	167	166	158	148	134	131	133	134	136	146	141	140
Reg. II	68.15	134	160	180	214	176	160	174	174	168	168	167	165	164	157	145	133	130	134	134	136	146	142	141
Reg. III	67.99	135	160	180	214	176	160	173	173	169	168	167	164	163	155	143	132	129	133	133	136	146	142	144
Reg. IV	70.49	132	157	180	214	173	152	167	166	164	163	159	155	154	145	133	126	122	125	126	127	137	132	131
Reg. V	76.66	133	158	179	218	171	153	168	167	163	164	160	156	156	148	137	129	125	129	128	131	141	137	136
Reg. VI	77.41	133	157	177	215	175	155	169	170	163	164	162	158	158	150	138	129	125	128	128	129	139	134	132
Reg. VII	75.62	131	157	175	212	177	158	170	170	165	166	163	160	158	151	139	131	128	130	129	131	140	135	133
Reg. VIII	78.15	133	160	176	208	173	157	171	171	166	167	164	161	161	154	143	133	130	133	134	135	144	141	140

(Indexes represent territorial index factors and are not necessarily applicable for determining unit reproduction costs upon individual roads.)

Railroad Cost Indexes by Accounts Applicable to Entire U. S., Regions I to VIII, Incl.

"Road" Construction	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
Engineering	134	159	178	214	175	157	171	171	166	166	164	161	160	152	143	131	127	131	131	133	142	138	137
Grading	130	165	190	250	170	143	160	164	149	153	143	135	133	123	118	106	98	100	101	99	103	93	90
Underground Power Tubes																							
Tunnels and Subways	128	150	183	208	179	165	179	179	179	178	169	155	155	143	130	119	111	122	120	130	139	141	140
Bridges, Culverts, etc	146	162	178	206	165	160	176	173	171	170	168	164	163	150	134	122	122	136	135	141	155	150	149
Elevated Structures	169	177	184	210	150	153	173	171	168	165	163	163	162	154	144	129	122	136	136	137	158	150	149
Ties	112	133	170	201	189	157	177	175	172	173	175	176	175	170	155	144	139	149	147	150	159	154	158
Rails	121	148	152	168	158	144	145	145	144	144	144	144	144	144	144	140	134	123	123	124	143	139	136
Other Track Material	198	210	203	209	192	161	182	179	177	177	177	177	170	169	165	163	158	150	147	150	169	169	170
Ballast	114	140	150	207	191	176	175	175	174	175	176	176	176	168	159	146	146	141	139	140	143	143	143
Track Laying and Surfacing	130	163	175	218	174	165	188	188	188	188	188	188	188	182	175	164	157	159	165	165	169	167	165
Right-of-way Fences	142	178	194	204	189	177	179	179	176	175	175	175	173	171	164	147	135	140	140	138	143	144	139
Snow, Sand Fences, Sheds	119	165	199	280	197	194	212	200	201	201	204	204	204	198	188	125	126	140	140	140	155	155	155
Crossings and Signs	137	161	182	208	171	164	178	175	171	169	166	165	165	161	153	131	127	139	137	139	152	145	142
Station and Office Bldgs	135	154	185	215	192	180	194	193	188	184	189	188	187	182	165	141	145	151	151	157	166	166	166
Roadway Buildings	136	156	185	216	192	178	196	196	189	187	192	191	190	186	166	140	145	150	150	150	162	162	162
Water Stations	159	170	191	213	185	178	187	187	186	182	185	186	184	177	161	147	151	155	155	156	166	166	166
Fuel Stations	153	160	190	212	181	166	185	185	182	180	183	183	183	174	159	144	149	154	154	153	159	159	159
Shops and Engine Houses	141	159	188	216	191	180	193	192	188	185	189	188	187	176	161	137	142	147	147	155	165	165	165
Grain Elevators	128	150	185	214	190	184	197	197	193	190	195	193	193	182	165	137	142	147	147	156	164	164	164
Storage Warehouses	135	155	185	210	193	178	198	198	193	189	193	191	191	184	165	137	142	147	147	154	166	166	166
Wharves and Docks	133	152	178	204	167	158	175	175	174	177	178	178	178	172	158	136	141	146	146	149	153	153	153
Coal and Ore Wharves	145	155	184	204	170	159	176	176	174	174	176	176	176	172	157	136	142	147	147	151	153	153	153
Gas Producing Plants	148	175	194	213	194	176	188	189	186	185	188	189	189	178	163	145	148	176	176	178	178	177	179
Telegraph and Telephone Lines	147	158	164	192	191	162	187	179	163	157	163	165	165	150	138	121	119	124	128	131	135	129	129
Signals and Interlockers	132	152	165	175	163	158	165	164	162	169	158	155	154	147	138	130	130	133	136	138	143	143	143
Power Dams, Canals, Pipe Lines																				151	149	149	149
Power Plant Buildings	141	158	189	218	197	184	196	196	191	186	191	191	189	177	162	138	143	148	148	152	167	167	167
Power Substation Buildings	137	156	187	216	194	180	197	197	192	188	193	191	190	176	161	137	142	147	147	138	164	164	164
Power Transmission System	190	181	186	176	145	132	142	136	140	141	137	142	150	136	116	98	98	103	105	108	123	110	110
Power Distribution System	178	192	189	205	172	163	178	172	175	176	175	178	181	173	148	144	144	148	151	152	155	149	149
Power Line Poles, Fixtures	145	169	194	230	208	179	209	203	185	183	198	199	209	200	172	147	147	150	153	148	157	152	152
Underground Conduits	119	172	206	250	228	214	220	215	220	216	219	219	217	215	175	175	175	180	184	185	185	185	185
Miscellaneous Structures	137	156	186	217	192	179	195	195	190	186	191	190	189	182	164	141	146	151	151	154	161	161	161
Paving	153	177	205	217	191	190	191	191	191	190	190	190	190	190	181	156	150	145	145	145	150	150	150
Roadway Machines	127	146	158	170	162	149	151	151	151	151	151	149	148	147	144	138	138	147	147	147	161	153	154
Roadway Small Tools	179	179	184	202	181	170	173	185	190	190	191	191	190	160	155	155	150	150	150	160	170	180	180
Shop Machinery	155	192	200	210	198	173	183	185	185	186	187	189	191	176	166	155	155	179	179	179	198	200	202
Power Plant Machinery	155	192	200	210	198	173	183	185	185	186	187	189	191	176	166	155	155	179	179	193	206	199	205
Power Substation Apparatus	155	192	200	210	198	173	183	185	185	186	187	189	191	176	166	155	155	155	150	145	149	151	150





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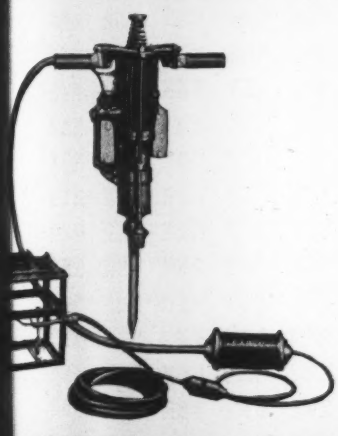

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Public Utility Construction Cost Index

Compiled and published by Whitman, Requardt and Smith, Consulting Engineers, Baltimore, Md., for the Estate of William W. Handy

Table No. 1 Cost Trends of Building Construction, 1911 to 1914 = 100

(Complete Index reports 13 items entering into Building Construction Costs)

Classes of Constr. Material & Labor Elements	1916	1917	1918	Jan. 1 1919	Jan. 1 1920	July 1 1920	Nov. 1 1920	Jan. 1 1921	Sept. 1 1921	Feb. 1 1922	Jan. 1 1923	Jan. 1 1924	July 1 1924	Jan. 1 1925	July 1 1925	Jan. 1 1926	July 1 1926	Jan. 1 1927	July 1 1927	Jan. 1 1928	July 1 1928	Jan. 1 1929	July 1 1929	Jan. 1 1930	July 1 1930	Jan. 1 1931	July 1 1931	Jan. 1 1932	July 1 1932	Jan. 1 1933	July 1 1933	Jan. 1 1934	July 1 1934	Jan. 1 1935	July 1 1935	Jan. 1 1936	July 1 1936	Jan. 1 1937	July 1 1937	Jan. 1 1938	July 1 1938	Jan. 1 1939	July 1 1939	Jan. 1 1940	July 1 1940	Jan. 1 1941
Atlantic Seaboard Division																																															
Reinf. Conc.	153	233	242	237	238	274	269	233	182	165	199	227	224	221	216	213	213	214	203	204	206	209	212	205	194	189	179	171	159	153	165	178	194	191	189	191	192	199	216	214	205	205	207	210	209	220
Brick	141	192	212	220	246	279	278	245	207	188	215	237	232	230	229	228	229	230	223	224	217	219	220	212	207	203	194	189	173	166	175	189	200	195	194	197	197	203	218	217	211	211	214	217	216	224
North Central Division																																															
Reinf. Conc.	153	230	230	220	220	270	263	228	181	163	193	219	214	212	208	203	201	205	194	195	197	200	203	199	190	185	177	169	154	151	162	175	186	182	182	186	187	196	209	209	200	200	200	202	201	210
Brick	140	189	198	199	224	272	269	238	201	181	206	225	218	216	215	212	211	214	208	209	201	203	205	199	195	192	186	181	164	161	170	183	190	185	184	188	189	197	07	208	203	203	203	205	204	210
South Central Division																																														
Reinf. Conc.	155	232	236	224	34	268	263	229	181	160	191	213	206	203	196	192	191	194	186	186	188	191	193	187	179	176	159	149	144	140	148	160	173	179	173	175	177	187	200	198	188	188	187	189	190	199
Brick	142	191	204	203	228	271	270	240	224	181	206	221	211	208	205	203	204	205	201	202	195	197	198	190	185	183	168	160	154	151	157	171	179	182	175	178	180	186	198	197	191	191	191	193	194	200
Plateau Division																																														
Reinf. Conc.	151	23	234	221	220	260	256	221	181	164	192	215	208	208	201	198	197	199	188	189	191	194	196	190	180	177	166	153	149	146	156	168	178	174	172	176	180	188	206	203	194	194	194	197	196	205
Brick	139	191	203	202	226	264	264	232	203	185	207	223	214	214	211	211	210	211	205	205	199	200	201	193	187	184	175	167	163	160	168	182	187	182	181	182	185	191	206	204	199	199	200	201	201	206
Pacific Division																																														
Reinf. Conc.	151	230	233	220	225	266	259	226	187	165	191	212	205	203	196	191	190	196	185	185	188	191	194	188	178	175	165	157	148	145	153	166	177	174	173	175	178	186	200	199	192	192	192	194	192	201
Brick	138	189	201	199	229	268	265	234	207	185	204	217	206	205	201	198	197	203	197	197	190	192	194	186	180	177	169	164	156	154	156	170	177	172	173	176	179	185	198	197	193	193	193	195	194	199

Table No. 2 Cost Trends of Gas Plant Construction, 1911 = 100

(Complete Index reports 17 items entering into Gas Plant Construction Costs) A, relates to Total Constr. & Equip.; B relates to Mech Equip. Exclusive of Gas Holders

	1913	1914	1915	1916	1917	1918	Jan. 1 1919	Jan. 1 1920	July 1 1920	Jan. 1 1921	Sept. 1 1921	Jan. 1 1923	Jan. 1 1924	July 1 1924	Jan. 1 1925	July 1 1925	Jan. 1 1926	July 1 1926	Jan. 1 1927	July 1 1927	Jan. 1 1928	July 1 1928	Jan. 1 1929	July 1 1929	Jan. 1 1930	July 1 1930	Jan. 1 1931	July 1 1931	Jan. 1 1932	July 1 1932	Jan. 1 1933	July 1 1933	Jan. 1 1934	July 1 1934	Jan. 1 1935	July 1 1935	Jan. 1 1936	July 1 1936	Jan. 1 1937	July 1 1937	Jan. 1 1938	July 1 1938	Jan. 1 1939	July 1 1939	Jan. 1 1940	July 1 1940	Jan. 1 1941
Atlantic Seaboard Division																																															
A....	108	107	112	136	186	229	239	253	279	265	205	224	241	238	234	229	230	230	226	223	215	216	216	219	218	216	214	208	202	188	176	178	189	216	216	217	218	218	225	246	246	244	241	249	253	253	257
B....	100	104	108	138	195	233	219	222	241	248	201	194	220	218	217	213	212	212	216	211	208	209	213	221	224	222	219	217	209	195	192	199	216	230	232	234	240	240	252	277	277	274	274	278	282	282	28_2
North Central Division																																															
A....	103	102	109	131	180	203	210	221	257	248	201	206	226	224	220	217	217	218	214	211	204	205	204	206	207	208	207	203	198	178	182	185	196	203	202	203	208	208	219	235	237	235	232	232	236	236	238
B....	100	104	108	138	195	233	219	222	241	248	201	194	220	218	217	213	212	212	216	211	208	209	213	221	224	222	219	217	209	195	192	199	216	230	232	234	240	240	252	277	277	274	274	278	282	282	282
South Central Division																																															
A....	103	102	114	145	182	213	214	223	251	246	203	196	214	210	205	199	199	200	198	195	187	187	187	190	188	187	185	177	171	160	158	167	177	184	195	196	202	202	208	223	222	219	216	217	220	220	223
B....	100	104	108	138	195	233	219	222	241	248	201	194	220	218	217	213	212	212	216	211	208	209	213	221	224	222	219	217	209	195	192	199	216	230	232	234	240	240	252	277	277	274	274	278	282	282	28_2
Plateau Division																																															
A....	103	103	107	128	180	207	207	214	234	231	194	193	210	206	206	201	202	202	198	195	187	189	189	191	189	188	186	181	176	166	170	173	184	191	190	190	195	195	202	221	221	220	216	217	220	220	223
B....	100	104	108	138	195	233	219	222	241	248	201	194	220	218	217	213	212	212	216	211	208	209	213	221	224	222	219	217	209	195	192	199	216	230	232	234	240	240	252	277	277	274	274	278	282	282	282
Pacific Division																																															
A....	104	102	107	128	180	207	209	228	255	248	212	203	219	215	211	206	205	206	206	203	196	197	197	201	200	198	197	191	187	177	180	178	189	196	195	197	198	203	210	228	228	230	227	228	232	231	235
B....	100	104	108	138	195	233	219	222	241	248	201	194	220	218	217	213	212	212	216	211	208	209	213	221	224	222	219	217	209	195	192	199	216	230	232	234	240	240	252	277	277	274	274	278	282	282	282

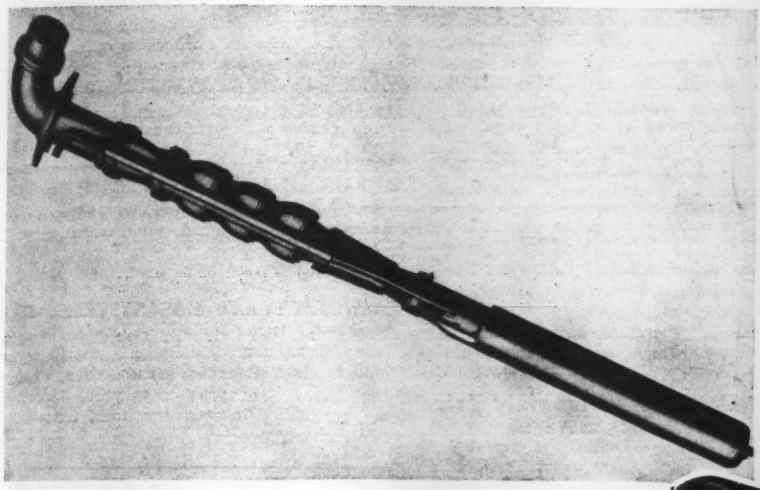
Table No. 3 Cost Trends of Electric Light and Power Construction, 1911 = 100

(Complete Index reports 50 items entering into Electric Light and Power Construction Costs) A, relates to Total Constr. & Equip.; B, to Electr. Plant — Steam; C, to Sub-Sta. Equip.

Classes of Constr. Material, Equipment and Labor Elements	1914	1915	1916	1917	1918	Jan. 1 1919	Jan. 1 1920	July 1 1920	Jan. 1 1921	Sept. 1 1921	Jan. 1 1923	Jan. 1 1924	July 1 1924	Jan. 1 1925	July 1 1925	Jan. 1 1926	July 1 1926	Jan. 1 1927	July 1 1927	Jan. 1 1928	July 1 1928	Jan. 1 1929	July 1 1929	Jan. 1 1930	July 1 1930	Jan. 1 1931	July 1 1931	Jan. 1 1932	July 1 1932	Jan. 1 1933	July 1 1933	Jan. 1 1934	July 1 1934	Jan. 1 1935	July 1 1935	Jan. 1 1936	July 1 1936	Jan. 1 1937	July 1 1937	Jan. 1 1938	July 1 1938	Jan. 1 1939	July 1 1939	Jan. 1 1940	July 1 1940	Jan. 1 1941
Atlantic Seaboard Division																																															
A.....	102	106	132	160	192	202	208	226	221	183	189	201	196	201	197	197	194	193	187	192	192	195	206	209	188	191	188	182	176	170	177	186	200	200	199	204	205	213	230	226	222	224	225	232	231	233
B.....	102	106	119	132	160	187	196	206	216	194	186	195	192	199	196	197	196	194	190	193	192	200	298	206	198	198	195	192	186	182	186	200	205	205	204	205	209	210	229	226	223	225	224	235	234	234
C.....	102	105	111	130	161	178	175	197	201	182	176	187	186	191	190	184	178	176	172	173	173	170	181	179	174	177	175	172	168	165	166	172	184	184	184	185	187	188	204	204	203	203	203	212	212	212
North Central Division																																															
A.....	100	105	129	154	178	184	189	214	210	176	179	193	189	194	192	190	187	187	182	186	186	189	199	199	184	188	187	186	174	172	179	187	195	195	194	199	199	209	224	222	216	219	218	222	221	222
B.....	100	102	112	123	145	163	172	188	197	179	171	185	185	189	189	189	188	188	185	188	187	195	202	203	195	197	199	199	186	186	189	203	204	203	202	204	205	209	227	225	222	224	223	225	224	224
C.....	100	102	104	122	145	155	151	180	184	167	162	178	179	182	184	178	171	171	168	169	169	167	177	176	172	177	179	181	169	169	171	176	184	184	184	184	184	187	204	203	202	203	202	203	203	203
South Central Division																																															
A.....	100	107	130	157	183	188	193	218	216	183	182	193	186	189	186	184	183	182	179	183	186	189	199	197	185	186	183	179	171	169	179	187	195	198	193	199	201	208	224	221	216	218	218	223	224	227
B.....	100	104	114	127	152	169	178	197	210	188	181	190	186	189	186	187	189	187	186	189	195	202	210	209	205	204	203	200	190	189	198	211	212	212	212	203	208	212	214	234	232	229	231	230	235	237	240
C.....	100	103	197	125	152	160	157	189	195	176	172	182	181	181	181	175	171	170	169	170	176	174	184	182	182	184	183	181	173	173	179	185	192	192	184	188	191	192	211	210	209	210	209	213	216	219
Plateau Division																																															
A.....	100	103	128	155	183	187	189	211	209	178	179	192	186	191	191	190	188	186	181	185	185	188	198	197	199	198	197	194	188	188	197	211	212	211	210	210	210	212	234	232	229	231	232	235	234	234
B.....	100	101	114	125	153	171	175	192	202	186	178	191	189	191	194	197	196	194	190	193	193	200	208	207	175	177	177	175	171	171	177	183	191	191	191	189	189	189	210	209	208	209	211	212	212	212
C.....	100	100	106	124	154	162	154	184	187	173	168	184	183	184	188	185	177	176	172	173	173	171	182	179																							
Pacific Division																																															
A.....	100	103	127	156	178	182	194	214	214	185	178	187	182	185	182	180	178	181	175	180	179	182	192	191	176	178	175	172	163	161	170	178	189	189	192	196	197	204	221	218	214	216	215	219	218	219
B.....	100	101	111	127	145	161	179	192	206	191	172	180	178	180	178	178	177	182	178	181	180	187	195	193	186	186	185	182	170	170	178	191	198	197	203	204	204	206	226	223	221	222	222	223	223	223
C.....	100	100	104	125	146	153	160	184	193	180	163	174	173	174	173	167	161	165	162	163	163	161	171	168	165	167	166	164	155	155	161	166	179	179	184	185	185	186	204	203	202	203	202	203	203	203

Bearing Reliability

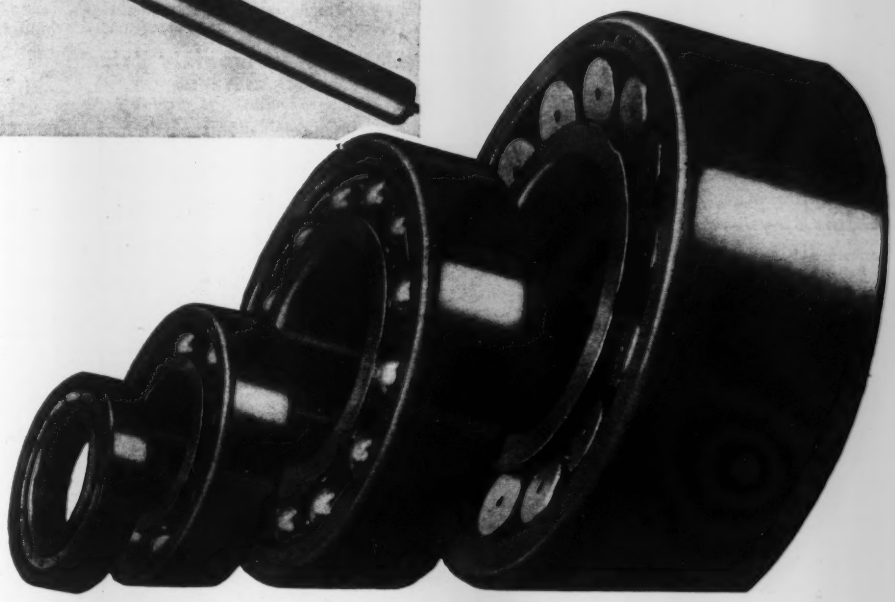
ALWAYS COUNTS ON SUBMERSIBLE PUMPS



SUBMERSIBLE MOTORPUMP

WE USE SKF BEARINGS

Byron-Jackson Co.



The *reliability* of SKF Ball Bearings on a Maricopa County Municipal Water Conservation District No. 1 deep-well installation proves that Mr. W. W. Lane, chief engineer of the district, was *right* when he selected SKF for super-duty. These bearings are built into the motor unit which is submerged with the entire pump below the surface in the well to deliver up to 3,000 gallons of water per minute with heads from 185 feet to 270 feet and using from 85 h.p. to 175 h.p. per unit. And doing that 24 hours a day during the irrigation season in Arizona without the slightest trouble speaks well for the performance of SKF Bearings.

SKF INDUSTRIES, INC., PHILA.

474C

SKF *Ball and Roller* **BEARINGS**

Relative Value of Utility Systems

C. F. Lambert, Utility Engineer and Consultant, Miami, Fla.

THIS RECORD brings up to Jan. 1, 1941, values of five utilities originally published in *Engineering News-Record*, May 7, 1925 and brought up to date annually in *Construction Costs*, 1931 to 1937.

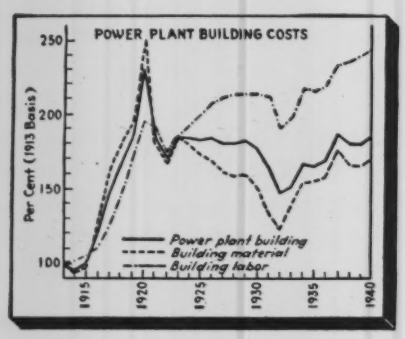
In computing each of these five utility value trends, additional plants have been added until about twice as many are now used as originally. The trend in equipment as well as in prices is thus followed. Values for each year are the average for the entire year.

Definition of the items used in computing these price trends is shown for each utility in the accompanying summary.

Table II shows values on a 1926 base, Table III on a 1913 base. Charts on the opposite page illustrate comparable annual values of all five utilities as well as the annual average trend, the preceding 5- and the preceding 10-year average trends, while Table I gives the 1940 monthly values which also are charted in an adjacent column to demonstrate the slight rise that occurred in the last half of the year. Power plant building values with labor and material trends are charted separately on this page.

Summary of Data Covered

POWER PLANT BUILDINGS: 50 buildings—Relative values shown by chart only, labor and material trends shown separately. *Building* items include cement in both plain and reinforced concrete, sand, crushed rock, brick, reinforcing steel, structural steel, roofing, sheet metal, windows, doors, heating material, electric lighting, common labor, carpenters, bricklayers, structural iron workers, metal workers, roofers and electricians.



WATERWORKS: 25 systems 68 items including *Land*, entirely a local matter (study indicates that the most accurate relation of land to other values is obtained by keeping land unit the same throughout the period); *Buildings; Equipment*, boilers, stokers, boiler settings, pumps, motors, steam pumps, condensers, steam piping, miscellaneous equipment, erection; *Distribution*, cast iron pipe, steel pipe, wood pipe, valves, hydrants, meters, standpipes, reservoirs, filter plants, labor; *Miscellaneous*, furniture, fixtures, tools, automobiles, miscellaneous.

ELECTRIC LIGHT PLANTS: 25 plants—84 items including *Land; Buildings; Equipment*, boilers, stokers, steam piping, auxiliary equipment, engines, turbines, diesels, condensers, generators, switchboards; *Distribution*, substation equipment, transformers, lighting equipment, poles, conductors, hardware, wire, insulators, meters, distribution transformers, underground cables, erection; *Miscellaneous*, furniture, fixtures, tools, automobiles, miscellaneous.

STREET RAILWAY SYSTEMS: 10 systems—82 items including *Land; Buildings*, car barns and shops; *Track Construction*, tangent track, special layouts, grading, paving, concrete and steel bridges, rails, spikes, bolts, ties, labor; *Span Construction*, poles, conductors, pole hardware, copper, erection; *Cars & Equipment; Miscellaneous*, furniture, fixtures, tools, automobiles, miscellaneous. Power plant buildings excluded because power is so frequently purchased from separate department or company.

NATURAL GAS PLANTS: 15 systems—58 items including *Land; Buildings; Equipment*, holders, small pumps, miscellaneous; *Distribution*, cast iron pipe, steel pipe, regulators, governors, valves, meters; *Miscellaneous*, furniture, fixtures, tools, autos.

MANUFACTURED GAS SYSTEMS: 25 plants—63 items including *Land; Buildings; Equipment*, boilers, gas machinery holders, miscellaneous; *Distribution*, cast iron pipe, steel pipe, regulators, valves, meters; *Miscellaneous*, furniture, fixtures, tools, autos.

Table I—Relative Monthly Value

For 1940 with 1913 = 100

	Waterworks	Electric Light	Street Ry.	Natural Gas	Artificial Gas
Jan	191.1	183.9	164.1	183.0	194.7
Feb	194.3	182.9	164.3	186.3	196.2
Mar	194.1	182.8	164.3	186.3	196.1
Apr	193.8	182.5	164.3	186.3	195.9
May	194.0	182.5	164.5	186.5	196.0
June	195.0	182.8	165.3	187.2	196.9
July	195.6	183.1	165.9	187.5	197.5
Aug	195.7	182.7	165.9	187.6	197.6
Sept	195.1	183.1	166.7	188.0	198.0
Oct	196.5	185.0	167.1	188.3	198.4
Nov	196.8	185.2	167.5	188.4	198.8
Dec	196.8	185.3	167.6	188.4	199.9
Average	195.2	183.5	165.5	186.9	197.2

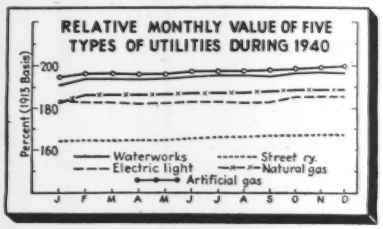


Table II—Relative Yearly Utility Values—Lambert Based on 1926 Costs

	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Waterworks Plants																
A	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
B	10.9	11.0	10.7	10.6	10.8	10.5	9.6	8.8	9.0	9.9	9.9	10.1	11.3	10.9	10.9	11.0
C	12.1	12.0	11.9	12.2	12.3	11.8	11.1	10.3	11.1	12.1	12.0	12.1	13.6	13.1	13.0	13.2
D	75.8	74.4	67.5	65.6	69.8	68.9	65.2	59.7	62.3	68.7	69.4	69.9	76.9	75.6	74.4	76.8
E	1.1	1.1	1.0	1.0	1.0	1.0	.8	.7	.9	.9	.9	.9	1.0	1.0	1.0	1.0
T	101.4	100.0	92.6	90.9	95.4	93.7	88.2	81.0	84.8	93.1	93.7	94.5	104.3	102.1	100.8	103.5
Electric Light Plants																
A	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
B	10.8	10.8	10.6	10.6	10.8	10.3	9.6	8.7	8.8	9.8	9.8	10.0	11.1	10.7	10.7	10.9
C	42.9	42.5	41.9	42.5	43.9	41.4	38.8	35.5	38.5	43.4	43.1	43.3	48.0	46.9	46.2	46.5
D	41.3	41.6	41.4	42.5	44.2	42.0	39.2	34.5	36.0	41.1	40.6	41.3	46.5	43.8	44.5	45.1
E	3.6	3.5	3.3	3.3	3.3	3.2	2.9	2.6	2.7	2.9	2.9	2.9	3.2	3.1	3.0	3.0
T	100.2	100.0	98.8	100.5	103.8	98.5	92.1	82.9	87.6	98.8	98.0	99.1	110.4	106.1	106.0	107.1
Street Railway Systems																
A	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
B	5.0	5.0	4.9	4.9	4.9	4.8	4.4	3.9	4.1	4.5	4.5	4.6	5.1	5.0	5.0	5.1
F	63.6	63.6	62.7	62.6	61.7	60.4	57.9	53.5	54.2	56.5	55.5	56.0	60.9	59.0	58.4	59.3
G	23.5	23.5	23.5	23.0	23.0	23.1	19.6	18.6	17.8	20.7	21.0	21.6	24.0	23.4	22.8	23.1
H	4.7	4.6	4.7	4.8	5.0	4.8	4.5	4.0	4.0	4.3	4.3	4.5	4.7	4.5	4.4	4.5
E	1.8	1.8	1.8	1.7	1.7	1.7	1.5	1.4	1.4	1.6	1.6	1.6	1.8	1.7	1.7	1.7
T	100.1	100.0	99.1	98.5	97.8	96.3	89.4	82.9	83.0	89.1	88.4	89.8	98.0	95.1	93.8	95.2
Natural Gas Plants																
A	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
B	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.3	1.3	1.4	1.4	1.4	1.6	1.6	1.6	1.6
C	1.6	1.6	1.6	1.6	1.5	1.5	1.4	1.3	1.4	1.5	1.6	1.7	1.8	1.8	1.8	1.8
D	93.3	93.0	90.6	90.8	91.2	89.9	87.5	82.7	83.2	90.0	89.4	86.1	92.8	91.3	89.6	92.0
E	2.9	2.9	2.8	2.8	2.8	2.8	2.6	2.3	2.3	2.4	2.4	2.4	2.6	2.6	2.5	2.5
T	100.3	100.0	97.4	97.6	97.9	96.6	93.8	88.5	89.1	96.2	95.7	92.5	99.7	98.2	96.4	98.8
Artificial Gas Systems																
A	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
B	6.6	6.7	6.5	6.4	6.6	6.4	5.9	5.4	5.5	6.1	6.1	6.2	6.9	6.6	6.6	6.7
C	32.2	32.3	32.1	31.6	31.2	28.7	26.2	25.2	27.4	30.6	31.3	31.8	37.1	37.3	37.0	37.1
D	57.1	56.8	54.0	53.8	55.3	54.6	53.2	49.3	49.5	54.3	54.3	53.4	57.3	56.4	55.4	57.2
E	2.1	2.0	2.0	2.0	2.0	1.9	1.8	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.8
T	100.2	100.0	96.8	96.0	97.3	93.8	89.3	83.7	86.1	94.9	95.6	95.3	105.3	104.3	103.0	105.0

A—Land. B—Buildings. C—Equipment. D—Distribution. E—Miscellaneous. F—Track Construction. G—Cars and Equipment. H—Span Construction. T—Total.

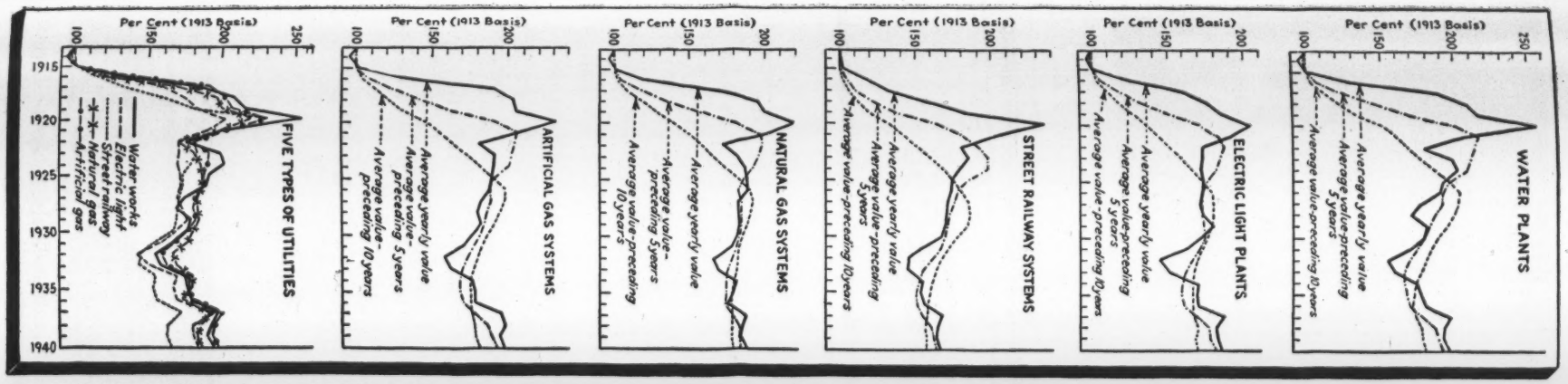


Table III—Relative Yearly Value of Main Items Entering Into Physical Value of Five Utilities 1913-1940—1913=100—Lambert

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Waterworks Plants																												
Land	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Bldgs.	11.2	10.8	11.1	13.3	16.5	18.5	20.6	25.6	20.9	19.0	20.8	20.7	20.6	20.7	20.2	20.1	20.4	19.7	18.2	16.6	16.9	18.7	18.6	18.9	20.9	20.5	20.6	20.9
Equip.	12.1	12.0	14.0	17.3	22.6	23.4	24.3	26.0	23.4	21.8	22.9	23.0	22.9	22.7	22.5	23.0	23.2	22.3	20.9	19.5	21.0	22.9	22.5	22.7	25.0	24.7	24.3	24.9
Distr.	72.7	67.1	71.3	94.1	143.2	161.1	165.8	197.8	155.8	130.1	149.8	152.2	143.2	140.5	127.5	123.8	131.8	130.0	123.3	112.6	116.8	129.7	130.7	131.8	144.8	142.7	140.2	144.7
Misc.	1.1	1.1	1.2	1.4	1.8	2.0	2.3	2.8	2.2	2.0	2.2	2.0	2.1	2.0	1.9	1.9	1.9	1.9	1.6	1.4	1.6	1.7	1.7	1.7	1.9	1.8	1.8	1.8
Total	100.0	93.9	100.5	129.0	187.0	207.9	215.9	255.1	205.2	175.8	198.6	200.8	191.7	188.8	175.0	171.7	180.2	176.8	166.9	153.0	159.2	175.9	176.4	178.0	195.5	192.6	189.8	195.2
Electric Light Plants																												
Land	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Bldgs.	10.1	9.7	10.0	12.0	14.9	16.7	18.5	23.1	19.9	17.1	18.8	18.6	18.5	18.6	18.2	18.2	18.5	17.8	16.5	14.9	15.2	16.8	16.7	17.0	18.8	18.4	18.5	18.8
Equip.	38.9	36.7	36.7	47.9	73.5	79.5	81.0	86.7	84.6	75.1	73.4	73.5	73.6	73.0	72.0	72.9	75.4	71.0	66.6	60.9	66.2	75.5	73.9	74.3	82.2	80.2	79.0	79.8
Distr.	44.8	43.5	47.1	56.1	63.4	69.6	75.2	82.6	77.4	70.4	70.4	69.6	70.9	71.2	71.1	72.9	75.8	71.7	67.1	59.4	61.8	70.3	69.2	70.3	79.3	74.6	75.7	77.0
Misc.	3.4	3.4	3.4	4.1	5.1	6.0	6.8	8.6	6.8	6.2	6.2	6.1	6.1	6.0	5.7	5.6	5.6	5.5	5.0	4.5	4.6	4.9	4.9	4.9	5.3	5.2	5.1	5.1
Total	100.0	96.1	100.0	122.9	159.7	174.6	184.3	203.8	191.5	171.6	171.6	170.6	171.9	171.6	169.8	172.4	178.1	168.8	158.0	142.5	150.6	169.3	167.5	169.3	188.4	181.2	181.1	183.5
Street Railway Systems																												
Land	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Bldgs.	4.7	4.5	4.6	5.6	6.9	7.8	8.6	10.8	8.8	8.0	8.8	8.7	8.6	8.6	8.5	8.5	8.6	8.3	7.6	6.9	7.1	7.8	7.8	7.9	8.8	8.5	8.5	8.7
Trk. Cstr.	64.3	63.1	63.4	71.9	83.3	104.8	113.8	144.1	119.9	105.4	113.6	112.8	110.2	110.2	108.6	108.5	106.9	104.7	100.1	92.9	94.1	97.9	96.0	96.9	104.6	102.2	101.2	103.1
Span Cstr.	5.8	5.4	6.3	8.7	9.9	9.7	10.0	11.1	9.0	8.5	8.7	8.8	8.1	8.0	8.1	8.4	8.7	8.4	7.8	7.0	7.0	7.5	7.4	7.7	8.2	7.8	7.7	8.0
Cars, eq.	20.9	22.4	22.8	25.1	27.2	31.1	44.4	61.1	59.1	53.0	47.0	42.9	40.7	40.7	40.7	39.9	39.9	39.9	34.0	32.4	30.8	35.8	36.4	37.3	41.6	40.5	39.4	40.1
Misc.	1.7	1.6	1.6	2.2	2.9	3.2	3.5	4.3	3.6	3.2	3.3	3.2	3.2	3.2	3.1	3.0	3.0	3.0	2.7	2.5	2.5	2.7	2.7	2.7	3.0	3.0	2.9	3.0
Total	100.0	99.6	101.3	116.1	132.8	159.2	182.9	234.0	203.0	180.7	184.0	179.0	173.4	173.3	171.6	170.9	169.7	166.9	154.8	144.3	144.1	154.3	152.9	155.1	168.8	164.6	162.3	165.5
Natural Gas Plants																												
Land	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Bldgs.	1.6	1.5	1.6	1.9	2.4	2.6	2.9	3.7	3.0	2.7	2.9	2.9	3.0	3.0	2.9	2.9	2.9	2.8	2.6	2.4	2.4	2.7	2.7	2.7	3.0	3.0	3.0	3.0
Equip.	1.7	1.6	1.8	2.6	4.0	3.6	3.5	4.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0	2.9	2.8	2.6	2.4	2.7	2.9	2.9	3.0	3.3	3.3	3.3	3.3
Distr.	92.2	89.9	92.0	111.0	155.7	182.9	186.5	202.4	187.3	158.4	168.7	173.2	175.0	174.6	169.9	170.3	171.1	168.8	164.7	155.0	157.8	169.0	168.2	163.0	175.5	172.6	169.4	174.2
Misc.	2.9	2.8	2.9	3.3	4.4	5.1	5.8	7.8	6.4	5.6	5.9	5.7	5.5	5.4	5.3	5.2	5.2	5.2	4.8	4.3	4.2	4.5	4.4	4.4	4.9	4.8	4.7	4.8
Total	100.0	97.4	99.9	120.4	168.1	195.8	200.3	219.6	201.4	171.4	182.2	186.5	188.1	187.6	182.7	183.0	183.7	181.2	176.3	165.7	168.7	180.7	179.8	174.7	188.3	185.3	182.0	186.9
Artificial Gas Systems																												
Land	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Bldgs.	6.8	6.5	6.7	8.1	10.0	11.2	12.5	15.5	12.7	11.5	12.6	12.5	12.4	12.5	12.2	12.1	12.4	12.0	11.1	10.1	10.3	11.3	11.3	11.5	12.7	12.4	12.4	12.7
Equip.	30.4	29.1	33.1	49.9	76.4	68.7	67.2	75.9	66.1	62.8	63.4	61.2	60.5	60.6	60.3	59.4	58.7	53.9	49.2	47.2	51.4	57.4	58.3	59.2	68.7	69.1	68.6	68.9
Distr.	56.5	54.4	55.6	68.1	98.3	114.8	116.5	130.4	115.6	98.2	107.5	108.6	107.3	106.7	101.5	101.0	103.8	102.6	99.7	92.5	93.8	102.1	102.0	100.3	108.0	106.2	104.4	108.0
Misc.	2.1	2.1	2.1	2.5	3.1	3.6	4.1	5.5	4.6	4.1	4.2	4.0	3.9	3.8	3.8	3.7	3.7	3.7	3.5	3.0	3.1	3.2	3.2	3.2	3.5	3.5	3.4	3.4
Total	100.0	96.3	101.7	132.8	192.0	202.5	204.5	231.5	203.2	180.8	191.9	190.5	188.3	187.8	182.0	180.4	182.8	176.4	167.7	157.0	162.8	178.2	179.0	178.4	197.1	195.4	193.0	197.2

ATLAS MANASITE DETONATORS

Another "ATLAS FIRST"

Some People always question Progress

FROM the steamboat to the stratoliner... from the pony express to the radio... progress has never gone unquestioned. People scoffed at Fulton, they laughed at Edison.

Atlas Manasite Detonators—a great step forward in safer blasting—have been no exception. Some people at first hesitated to use them. Yet—more and more blasters are using Atlas Manasite Detonators. Once they try them, blasters like the dependability of Atlas Manasite Detonators. Reorders and new orders tell the story—over 100,000,000 already have been used.

Atlas Manasite Detonators offer an increased margin of safety . . . with no sacrifice in detonating efficiency, and at no increase in cost. Safety precautions become, not less important, but more effective.

Are you using this advance in greater safety?

ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington, Del. • Offices in principal cities • Cable Address—Atpowco

Dipper Designed for Faster Digging and Fuller Loads.

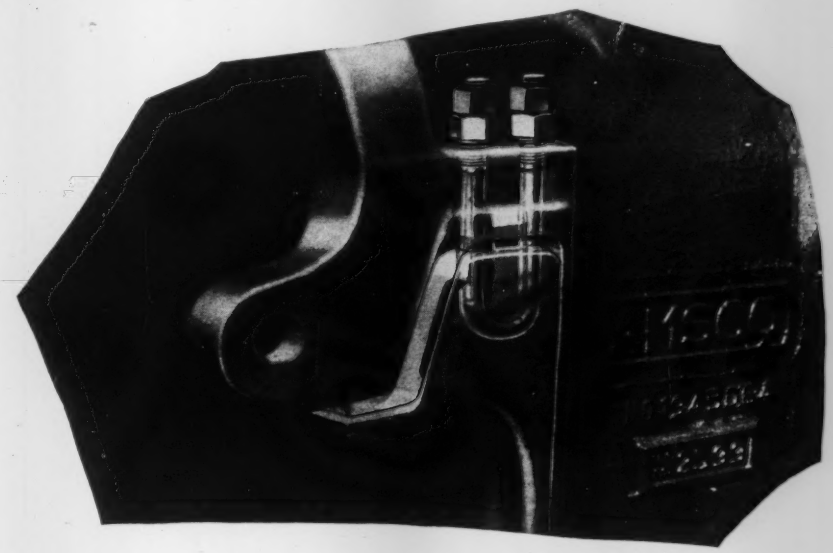
"U" Bolt and Interlock Fastening Speeds Up Lip Replacements

The Amsco all-manganese steel renewable lip dipper (U. S. Patent No. 1,945,064) takes a bigger bite and a greater heap-load because of the "rolling in" action of the extended lip contour with its sharp full-sweep sides, the finger-like arrangement of the teeth, and the smooth, unobstructed body interior.

Together with light dipper weight and fast operating door, these features aid maximum speed of shovel operation. Quick dumping is insured by a four-sided taper of the dipper body outwardly from the top to the door.

Renewable lips, of course, are old in digging practice, but not until the introduction in 1930 of this Amsco dipper was it possible to avoid the delay in shovel production, the difficulty and expense involved in removing a worn riveted lip and re-riveting another one on. Unless a spare dipper was on hand, the change involved shutting the shovel down while the dipper was taken to a shop and the tedious work performed with tools and under conditions not available at the point of digging.

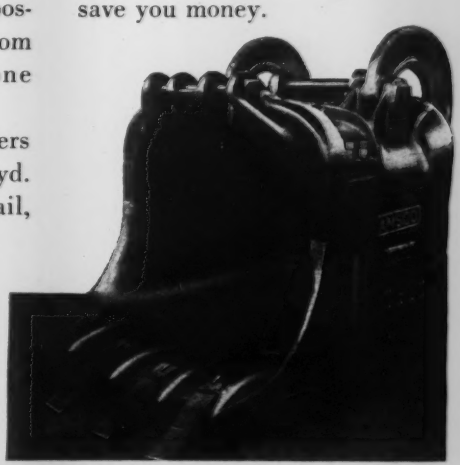
Now all that is necessary in removing a worn Amsco lip is to loosen the "U" bolts between lip and back, remove four pins between lip and front, and it's *done*. Installation of the new lip is just as quick and simple—no rivets, no special tools, and yet the lip is fastened as securely to the body (or more so) as if riveted. And the shovel is "down" a matter of minutes rather than hours—or days.



Made of genuine tough, work-hardening and polishing 13% manganese steel, the greatest possible wearing life and freedom from breakage is a foregone conclusion.

Amsco Renewable Lip Dippers are made in all sizes from ¾ yd. capacity up, with or without bail, and with back lugs arranged to take any dipper stick. Smaller sizes (⅝, ½ and ⅜ yd.) are made without the renewable lip feature.

Tell us, or your shovel manufacturer, your digging problem—we're sure an Amsco dipper can be made to fit your needs and save you money.



Amsco

GENUINE MANGANESE STEEL, *"THE TOUGHEST STEEL KNOWN"*

AMERICAN MANGANESE STEEL DIVISION, Chicago Heights, Ill.
OF THE AMERICAN BRAKE SHOE & FOUNDRY CO.

FOUNDRIES AT CHICAGO HEIGHTS, ILL., NEW CASTLE, DEL., DENVER, COLO., OAKLAND, CALIF., LOS ANGELES, CALIF. ST. LOUIS, MO. OFFICES IN PRINCIPAL CITIES.

Boeckh Index of Construction Costs — U. S. Average, 1926–'29 = 100

Annual Averages By Cities	Residences		Apartments, Hotels, Office Bldgs.			Commercial & Factory Bldgs.				
								Brick and		
	Frame	Brick	Wood	Conc.	Steel	Frame	Steel	Wood	Steel	Conc.
ATLANTA AREA										
1926–29	82.7	87.0	84.2	83.7	87.0	82.9	94.5	84.7	87.5	86.8
1913	41.2	43.7	42.4	43.3	45.6	40.6	45.2	43.0	44.3	43.0
1916	46.0	48.9	48.9	52.6	55.5	44.8	66.9	48.4	57.6	53.8
1917	54.4	57.2	56.6	63.7	69.4	46.0	90.6	56.6	74.4	63.9
1918	71.3	74.8	72.7	74.6	80.1	69.7	93.2	72.4	80.7	75.4
1919	103.6	105.1	100.6	87.0	95.0	105.5	95.3	96.1	90.9	86.5
1920	137.1	139.6	133.1	110.6	119.6	140.6	111.8	129.6	108.5	111.0
1921	85.1	88.1	83.9	81.9	84.0	84.5	75.6	82.2	76.8	84.0
1922	83.4	85.8	81.8	79.6	82.2	83.6	73.1	79.5	74.6	80.6
1923	88.6	92.8	89.1	88.9	91.5	88.3	86.7	88.0	86.1	91.9
1924	85.0	89.8	89.2	91.1	91.9	88.8	88.8	88.3	89.8	94.7
1925	81.7	86.5	85.6	88.6	88.6	85.3	89.4	85.1	83.4	92.5
1926	83.1	87.1	83.7	85.1	86.4	82.1	93.4	84.5	86.6	85.1
1927	82.4	85.9	83.6	83.2	84.6	81.8	96.5	84.2	85.5	85.6
1928	85.6	89.4	86.7	86.0	87.9	84.8	93.3	85.7	88.5	86.6
1929	79.7	85.6	82.8	80.5	88.2	82.9	94.8	84.4	89.4	89.9
1930	80.9	85.3	82.8	84.5	85.7	78.2	91.8	83.6	83.6	86.1
1931	78.6	82.8	80.2	80.4	80.4	77.2	82.2	81.6	80.4	82.1
1932	71.0	75.2	73.6	77.2	77.0	68.7	80.8	77.4	78.1	78.3
1933	64.6	69.6	68.3	77.9	76.1	62.7	79.5	71.8	79.0	82.0
1934	70.6	76.6	74.6	83.8	83.4	68.9	91.5	78.5	86.4	87.4
1935	68.4	72.4	73.2	83.9	82.6	64.9	89.7	77.7	85.6	87.6
1936	68.4	72.4	73.2	84.4	83.3	65.8	89.7	77.8	85.8	87.1
1937	79.0	85.1	82.8	92.7	92.2	76.7	97.9	85.7	93.7	95.2
1938	81.6	85.0	85.2	95.9	96.2	79.5	100.5	87.4	96.9	98.1
1939	82.8	86.0	86.1	95.1	95.0	80.6	96.2	88.6	94.6	97.4
1940	88.1	90.3	90.6	96.8	97.3	86.3	100.1	91.5	97.3	98.4
BALTIMORE AREA										
1926–29	107.2	112.0	107.6	100.6	100.7	106.3	95.5	106.8	96.8	101.2
1936	80.9	85.8	82.4	89.4	88.0	80.0	88.4	86.5	88.3	90.3
1937	88.8	93.2	90.4	93.4	93.8	87.9	97.0	91.8	95.4	93.0
1938	91.9	94.8	94.1	98.0	98.0	91.7	100.4	95.6	99.5	98.5
1939	93.5	95.5	95.6	99.3	99.2	94.0	101.7	96.6	101.4	100.2
1940	100.1	101.3	102.0	102.5	103.0	101.0	105.3	102.7	106.1	103.3
BOSTON AREA										
1926–29	116.3	120.3	115.4	106.2	107.0	118.8	106.3	112.5	108.7	105.8
1936	87.9	94.2	90.8	96.4	93.9	87.3	98.5	92.9	98.6	98.1
1937	103.3	110.5	106.6	111.6	109.2	103.5	112.1	107.6	114.4	113.2
1938	104.1	109.4	107.8	114.5	111.9	103.8	113.9	109.1	117.0	116.4
1939	106.2	110.4	110.1	116.3	113.7	105.7	114.2	111.5	118.2	118.5
1940	111.7	114.7	114.3	116.9	114.9	112.3	114.6	114.6	119.1	119.2
CHICAGO AREA										
1926–29	109.2	114.2	109.8	113.2	109.1	112.9	105.2	105.9	112.0	116.0
1936	97.2	102.9	97.8	110.0	103.9	100.4	105.0	96.6	109.7	115.9
1937	104.8	110.7	105.9	116.9	111.8	108.3	109.1	104.0	115.3	120.8
1938	107.9	110.6	109.5	122.7	117.8	111.5	117.9	108.0	122.4	126.7
1939	110.6	112.5	111.1	123.6	118.7	114.2	117.6	109.3	122.6	127.6
1940	117.3	117.8	116.5	124.9	120.9	121.8	118.5	113.4	124.2	128.4
CINCINNATI AREA										
1926–29	100.5	105.0	101.3	101.0	100.2	100.2	99.6	103.1	100.6	101.0
1936	84.5	89.9	87.7	93.2	90.8	81.9	92.6	91.8	92.6	93.3
1937	98.8	106.1	102.9	107.5	105.3	98.2	107.9	104.7	109.1	109.7
1938	100.4	105.1	104.0	112.4	109.2	100.0	111.7	106.0	113.4	114.8
1939	103.3	106.2	105.9	113.9	110.4	103.3	111.7	107.1	113.7	116.5
1940	105.9	108.6	107.8	116.0	112.4	105.9	112.3	108.9	114.5	119.2
CLEVELAND AREA										
1926–29	107.2	113.4	108.5	111.3	108.3	109.0	103.0	107.2	110.5	114.8
1936	91.7	98.8	94.7	100.0	95.1	92.3	98.1	94.0	101.2	100.3
1937	105.1	112.3	107.7	112.5	109.1	106.5	110.6	108.1	114.8	116.3
1938	105.8	109.8	109.4	115.5	112.8	107.0	113.0	109.9	118.1	118.3
1939	106.2	109.6	109.5	115.3	112.8	107.5	112.9	109.5	117.7	118.0
1940	107.8	111.1	110.9	116.1	113.5	109.2	112.3	110.5	117.9	119.2
DALLAS AREA										
1926–29	103.1	107.3	103.2	98.8	99.1	103.6	100.5	100.9	99.4	99.7
1936	82.5	87.1	84.1	84.5	84.8	81.4	88.0	85.8	86.9	85.1
1937	89.9	95.2	92.2	92.0	94.2	88.5	95.0	94.4	94.1	92.3
1938	91.2	92.6	92.7	95.5	96.6	89.7	102.5	93.6	98.1	94.8
1939	95.1	95.8	96.7	98.8	100.2	94.8	106.6	96.0	101.9	98.9
1940	100.7	100.7	101.8	101.1	103.3	100.9	112.8	100.5	106.6	100.6
DETROIT AREA										
1926–29	103.3	108.4	104.3	102.9	102.4	103.7	103.1	103.5	103.3	104.4
1936	80.6	85.9	84.1	91.9	90.2	80.5	95.9	84.2	95.2	95.3
1937	93.9	100.7	97.3	103.4	101.7	94.3	107.0	97.6	107.4	106.5
1938	97.1	101.8	101.8	108.7	107.3	96.9	110.3	102.9	112.5	110.5
1939	98.8	102.7	102.9	108.6	107.5	98.7	108.8	104.2	111.4	110.1
1940	103.3	106.0	106.3	109.2	108.7	103.6	109.7	106.4	111.6	110.6
MINNEAPOLIS AREA										
1926–29	92.8	98.2	94.6	95.6	96.1	92.8	100.0	93.9	97.9	98.4
1936	88.6	93.6	89.2	92.6	91.6	88.7	96.1	89.2	94.3	95.7
1937	101.6	107.6	104.2	108.6	106.8	103.0	111.7	101.8	111.6	112.1
1938	101.2	105.5	103.9	113.4	111.2	102.1	114.7	103.3	115.2	117.2
1939	101.9	105.0	104.2	113.5	110.7	102.7	113.4	103.6	114.5	117.2
1940	106.1	108.2	107.5	113.6	111.7	107.8	113.8	105.4	115.3	117.2
NEW ORLEANS AREA										
1926–29	93.3	96.3	93.4	86.5	90.6	93.3	93.7	91.5	89.5	86.5
1936	73.4	78.8	76.6	81.8	83.2	70.4	88.9	77.6	83.7	82.6
1937	83.4	87.0	84.7	86.6	89.9	82.6	98.1	84.4	91.6	85.6
1938	86.3	87.5	88.5	92.2	95.6	85.0	102.0	88.3	96.0	91.5
1939	89.0	90.3	91.3	95.4	98.3	88.1	102.8	91.7	98.5	94.9
1940	97.3	97.4	98.1	100.3	102.2	97.3	104.7	97.9	101.6	99.2
PHILADELPHIA AREA										
1926–29	100.3	106.3	103.7	105.9	103.1	98.1	101.9	104.2	104.1	107.5
1936	88.7	95.5	93.0	96.5	92.6	85.7	91.7	97.2	94.7	98.9
1937	91.4	98.0	95.3	98.7	97.8	89.1	100.9	97.7	99.7	100.3
1938	93.8	98.5	98.6	104.6	102.2	92.4	103.7	101.7	104.7	106.7
1939	99.2	102.6	102.9	105.7	104.1	98.2	102.0	105.0	105.5	106.7
1940	103.0	105.4	106.0	106.7	106.1	102.1	104.9	107.4	107.9	107.5

Annual Averages By Cities	Residences		Apartments, Hotels, Office Bldgs.			Commercial & Factory Bldgs.				
								Brick and		
	Frame	Brick	Wood	Conc.	Steel	Frame	Steel	Wood	Steel	Conc.
NEW YORK CITY AREA										
1926–29	133.3	138.4	131.9	122.8	120.4	137.5	113.1	127.4	125.2	125.3
1913	59.5	60.6	57.5	53.9	54.8	61.4	51.4	53.2	53.2	53.7
1916	65.9	67.5	65.1	62.3	65.2	67.8	75.6	62.3	69.0	62.1
1917	77.6	78.9	76.4	73.2	78.7	79.9	97.0	72.5	83.9	72.3
1918	87.7	89.9	86.4	82.2	87.2	89.2	98.2	83.6	89.2	83.1
1919	100.5	103.5	99.3	92.0	96.9	101.2	97.1	97.2	93.6	91.6
1920	136.9	142.0	135.8	123.3	130.0	137.1	120.9	135.0	122.6	123.6
1921	109.8	114.5	109.2	101.3	100.8	110.0	96.1	109.1	100.1	103.5
1922	109.5	114.3	109.0	99.0	98.7	109.8	88.4	109.3	96.3	100.1
1923	124.6	131.3	125.6	112.3	112.2	125.5	105.7	127.0	112.7	115.8
1924	123.5	129.1	123.6	114.4	113.9	125.0	108.5	122.4	115.6	115.7
1925	122.8	126.9	120.4	111.4	110.1	125.7	104.2	117.5	110.3	113.3
1926	131.4	136.9	130.1	120.3	116.7	133.7	118.3	128.1	118.2	120.0
1927	128.4	133.3	126.4	117.2	113.1	131.4	106.5	123.6	115.6	119.9
1928	136.5	140.2	133.5	125.8	122.6	140.5	112.4	126.6	122.2	128.0
1929	140.6	143.2	137.6	127.9	129.2	144.4	115.2	131.3	130.8	130.3
1930	126.7	132.6	125.3	124.1	118.7	131.9	113.8	120.3	123.6	124.0
1931	117.8	124.0	117.8	119.7	113.9	122.7	116.7	113.4	122.8	123.8
1932	100.4	108.1	102.6	105.5	99.8	104.8	102.2	99.8	109.1	112.0
1933	85.0	92.4	88.4	101.1	93.3	85.2	90.1	91.0	97.6	106.2
1934	98.3	104.5	100.2	108.2	103.5	99.8	104.6	100.2	108.8	112.2
1935	92.2	92.5	93.2	103.6	99.6	94.1	102.9	92.9	105.1	107.4
1936	96.4	101.8	97.4	106.8	102.2	98.8	104.9	96.2	107.2	110.5
1937	110.5	115.8	111.2	119.6	116.5	113.1	117.8	109.1	120.6	121.2
1938	118.9	121.4	119.6	128.4	124.0	121.9	123.2	117.0	128.3	130.4
1939	122.1	123.3	122.5	130.6	125.9	125.6	123.7	119.6	130.0	133.3
1940	124.6	125.7	125.1	132.0	127.4	128.0	124.3	122.2	131.2	134.9
PITTSBURGH AREA										
1926–29	113.3	118.8	112.8	111.2	107.1	115.4	89.6	112.2	104.6	112.9
1936	92.8	100.4	95.8	97.9	93.8	92.4	82.6	98.4	93.4	101.8
1937	109.8	117.5	112.9	112.1	109.0	109.1	102.1	115.3	110.6	114.1
1938	112.7	116.4	114.7	117.1	113.7	113.2	114.2	115.6	116.6	118.9
1939	113.8	117.0	115.7	117.5	114.2	114.2	109.8	116.5	116.9	119.1
1940	115.0	117.3	116.7	117.7	114.4	115.6	109.5	117.4	116.2	119.3
ST. LOUIS AREA										
1926–29	118.6	121.1	115.7	109.9	108.8	121.3	103.3	111.7	107.7	109.3
1913	62.6	63.7	60.0	56.7	57.3	63.9	53.4	57.8	54.7	57.6
1916	58.8	61.3	59.7	62.6	64.9	59.5	79.9	58.1	70.1	62.8
1917	69.7	71.4	69.5	71.7	79.5	71.1	95.3	66.5	81.3	71.5
1918	88.4	89.8	86.3	82.5	87.9	90.6	99.2	81.4	89.1	82.7
1919	95.0	97.5	93.6	91.4	96.4	96.7	99.1	90.1	93.8	91.6
1920	121.0	123.3	118.5	112.1	120.0	123.4	116.1	113.7	113.1	110.7
1921	113.3	116.5	110.5	105.0	104.1	115.3	99.4	107.4	103.2	106.7
1922	98.1	102.4	97.9	96.2	95.7	98.7	89.6	96.8	93.9	97.4
1923	116.5	120.9	115.4	110.2	110.2	119.0	104.9	112.6	109.4	111.7
1924	122.1	126.9	120.7	117.3	114.6	125.0	109.1	117.8	115.7	119.2
1925	118.4	123.6	117.9	116.3	113.2	120.9	107.0	115.6	114.4	118.1
1926	120.7	125.4	119.6	115.5	112.8	123.8	106.5	116.5	114.3	116.9
1927	118.1	122.7	116.7	113.5	110.1	121.2	105.4	113.5	112.5	116.0
1928	117.9	119.2	114.2	106.6	97.5	121.1	102.7	110.6	103.6	106.6
1929	117.7	118.1	112.3	104.0	97.2	119.0	98.6	106.2	100.4	103.8
1930	108.3	113.2	108.4	112.4	107.9	110.6	106.2	106.0	111.3	115.3
1931	130.3	108.4	104.0	108.0	102.9	105.6	102.8	102.1	107.8	110.5
1932	95.0	100.7	96.5	99.0	94.6	97.1	97.0	95.0	101.2	102.4
1933	87.3	94.0	90.1	97.9	93.2	88.4	96.8	90.2	99.6	102.8
1934	97.6	105.5	101.7	105.9	102.3	97.2	102.6	103.7	107.6	109.7
1935	91.6	99.7	96.4	104.2	99.3	90.7	101.8	98.9	105.7	108.6
1936	91.0	99.1	95.5	104.9	100.7	90.5	103.3	98.1	106.2	106.3
1937	98.2	106.5	103.2	113.1	111.1	97.8	114.8	106.0	117.0	117.6
1938	104.1	108.5	107.5	118.5	116.4	103.7	117.1	108.5	120.5	122.4
1939	107.0	110.2	109.9	118.7	116.4	107.6	114.3	110.3	119.2	119.8
1940	109.2	111.9	111.6	119.2	117.0	109.9	113.4	111.6	119.2	120.3
SAN FRANCISCO AREA										
1926–29	87.7	93.7	90.4	97.5	96.5	86.1	95.5	91.8	95.9	99.0
1913	51.7	56.8	55.0	63.8	61.4	49.7	68.8	57.1	64.4	67.8
1916	54.1	59.3	58.3	67.6	67.7	52.2	86.2	60.2	73.9	70.1
1917	63.0	67.7	67.8	77.2	81.9	61.7	118.7	68.0	94.6	78.1
1918	76.6	81.0	79.1	85.8	89.1	75.5	109.2	78.7	94.3	87.4
1919	87.8	92.7	90.1	96.7	100.1	87.2	112.1	89.7	102.2	98.5
1920	107.5	112.8	109.8	115.2	121.1	106.9	133.0	109.6	122.1	115.1
1921	89.5	96.8	93.8	102.3	100.2	88.3	106.5	97.2	103.8	105.6
1922	88.3	94.7	91.1	97.1	95.2	86.9	94.9	92.9	95.6	100.5
1923	98.7	104.8	100.8	103.1	103.0	98.8	103.5	100.8	103.1	106.4
1924	86.7	94.2	91.2	99.9	98.0	84.6	99.7	94.3	99.7	103.8
1925	86.5	93.9	91.1	99.5	97.9	84.1	97.0	93.4	98.0	102.1
1926	88.6	96.5	92.2	103.3	100.3	87.3	100.0	95.2	102.6	107.0
1927	87.2	94.8	91.2	102.1	98.3	86.1	97.2	93.1	100.5	103.3
1928	88.1	93.2	90.1	93.1	94.9	86.0	93.5	90.8	90.5	94.4
1929	86.9	90.3	88.1	91.9	92.5	85.0	91.3	88.1	90.0	92.3
1930	86.8	93.8	90.3	100.4	96.8	86.2	100.0	92.0	100.4	104.9
1931	80.6	88.8	85.6	94.6	90.6	79.2	92.5	87.3	94.8	100.7
1932	76.4	84.3	81.6	87.9	84.0	75.4	88.0	84.6	89.8	94.1
1933	68.4	76.7	74.3	84.7	81.0	66.3	82.1	78.5	85.3	89.5
1934	85.0	93.2	90.5	97.5	94.5	82.9	97.2	94.7	99.3	102.4
1935	84.1	91.6	89.0	96.5	94.9	82.1	99.9	92.9	99.8	103.7
1936	86.5	95.6	92.3	103.5	99.8	84.8	102.6	96.2	104.3	109.7
1937	96.7	104.3	101.9	112.2	109.8	95.4	113.0	104.8	113.3	116.0
1938	97.7	105.3	101.8	115.8	112.3	96.1	115.7	105.9	116.0	120.2
1939	99.2	105.7	104.5	117.4	114.4	97.6	114.9	107.4	116.5	121.9
1940	100.7	106.0	106.0	116.4	114.1	99.6	112.2	108.1	115.7	120.4
SEATTLE AREA										
1926–29	84.5	92.2	89.2	101.7	95.1	82.4	100.8	92.2	100.5	105.9
1936	79.8	86.5	83.6	93.7	92.2	77.3	97.4	85.7	95.2	96.5
1937	92.6	103.5	100.4	116.0	110.0	90.0	117.0	106.8	118.1	122.2
1938	96.5	104.3	103.5	119.8	115.7	94.0	120.2	107.6	120.8	125.6
1939	96.7	104.4	103.8	119.2	114.9	94.4	115.1	108.3	118.7	125.3
1940	99.0	106.2	105.5	119.1	115.1	97.2	112.8	109.4	117.7	124.9

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See page 92, Apr. 27, 1939 issue for 1914 and 1915 data of long series.

For definition of this index see p. 104

THERE'S A MODEL OF
SKILSAW
to speed up your sawing
on every size of lumber you use!
MODEL "67"
SIX-INCH BLADE
Rips and cross-cuts hardwood up to 1 in. Cross-cuts dressed pine up to 2 in. Bevel-cuts 1¾ in. lumber at 45°. Cutting capacity 1⅞ in. Length Overall 15½ in. Weight 11½ lbs.
1⅛"
MODEL "77"
SEVEN-INCH BLADE
Cross-cuts 2 in. rough lumber and bevel-cuts 2 in. dressed lumber at 45°. Cutting capacity 2⅜ in. Length 18 in. Weight 15 lbs.
2⅜"
MODEL "87"
NINE-INCH BLADE
Cross-cuts 3 in. dressed lumber and bevel-cuts 2¾ in. lumber at 45°. Cutting capacity 2⅞ in. Length Overall 19 in. Weight 22 lbs.
MODEL "127"
TWELVE-INCH BLADE
Rips and cross-cuts timbers up to 4 in. full. Bevel-cuts 3⅛ in. lumber at 45°. Cutting capacity 4¾ in. Length 22 in. Weight 32 lbs.
2⅞"
4⅜"

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GETS SAWING COSTS DOWN... GETS JOBS DONE FASTER!

EVERY cut you make in EVERY size of building lumber . . . can be made quicker, easier, cheaper with these four models of SKILSAW—the best built, fastest cutting, easiest-to-operate electric saw on the market. Each of these four models has every engineering improvement to insure trouble-free service for a long stretch of years:

- Quick adjustment for depth of cut
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- Telescoping guard rotates on ball bearings
- Blower keeps line of cut clear of sawdust
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Only SKILSAW has *all* of these quality construction features . . . that's why SKILSAW is *more* for your money and will make *more* money for you on every job!

9 POWERFUL MODELS FOR WOOD, METAL STONE AND COMPOSITIONS

SKILSAW, INC., 4771 Winnemac Ave., **Chicago**

36 East 22nd Street, New York—52 Brookline Avenue, Boston—182 Main Street, Buffalo—15 South 21st Street, Philadelphia—2902 Euclid Avenue, Cleveland—2124 Main Street, Dallas—918 Union Street, New Orleans—29 North Avenue, N. W., Atlanta—2645 Santa Fe Avenue, Los Angeles—2065 Webster Street, Oakland—1535 Grand Avenue, Kansas City, Mo.—1115 E. Pike Street, Seattle—Canadian Branch: 85 Deloraine Avenue, Toronto, Ontario, Canada

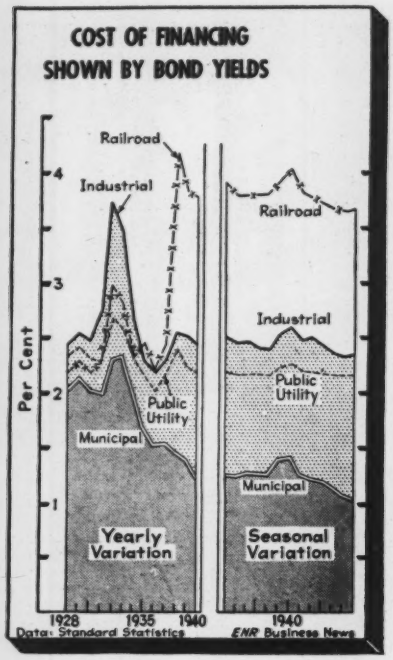
Cost of Financing

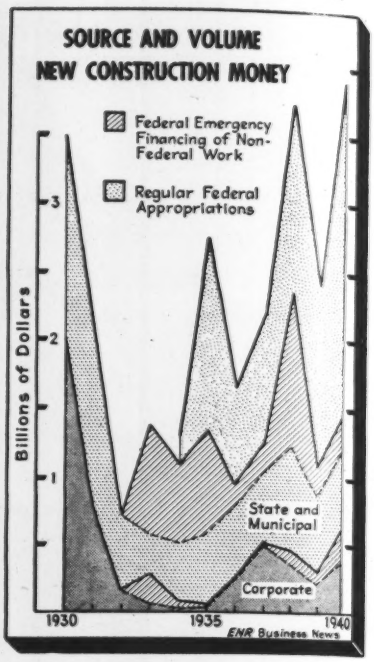
Cost of construction money during 1940 fell below 1939 for treasury, municipal, industrial, public utility and railroad bonds. Yields of high-grade municipal bonds dropped 9 percent under the average for 1939, to a new all-time low. United States Treasury bond yields, also at unprecedented low levels, were 6 percent below 1939. Industrial bond yields decreased 3 percent; public utilities, 2 percent; and railroad bonds, 1 percent.

The 1940 annual average yields for the various types of high-grade bonds in percent are: U. S. Treasury, 2.21; municipal, 2.50; industrial, 4.88; public utilities, 4.37; and railroad issues, 7.57. February figures for treasury and municipal bonds have climbed from their 1940 lows of December, and stand at 2.09 percent for treasury, and 2.27 for municipal. Industrials at 4.65 for February, public utilities at 4.30, and railroads at 7.21 percent, however, are lower than the December yields.

Commercial loan rates, or averages of rates charged by banks in principal cities declined slightly in the last quarter of 1940. The year-end New York City rate, 2.00 percent compares with 2.14 for the third quarter of 1940. The rate for seven northern and eastern cities at the end of 1940, 2.53 percent, compares with the third-quarter value of 2.56. Eleven southern and western cities' December charge, 3.36, is below the 3.43 percent rate at the end of September.

The 1940 fourth quarter rate shows changes in the various groups of cities reporting, but the average rate for the 19 cities, 2.59 percent, is unchanged from the 1939 year-end figure as reported by the Federal Reserve Board.





Bond Yields—Percent

	U. S. Treas.	Municipal	Industrial	Pub. Util.	Railroad
	(1)	(2)	(3)	(4)	(5)
1932 Aver.	3.68	4.65	7.46	5.36	5.99
1933 Aver.	3.31	4.71	6.93	5.18	5.65
1934 Aver.	3.12	4.03	5.30	4.62	4.66
1935 Aver.	2.79	3.41	4.61	4.31	4.93
1936 Aver.	2.65	3.07	4.37	4.02	4.42
1937 Aver.	2.68	3.10	4.60	4.35	4.92
1938 Aver.	2.56	2.91	5.07	4.80	8.37
1939 Aver.	2.36	2.76	5.01	4.48	7.65
1940 Aver.	2.21	2.50	4.88	4.37	7.57
1940 Jan.	2.30	2.54	4.92	4.34	7.56
Feb.	2.32	2.60	4.93	4.33	7.57
Mar.	2.25	2.58	4.81	4.34	7.57
Apr.	2.25	2.56	4.78	4.32	7.61
May	2.38	2.81	5.05	4.48	7.88
June	2.39	2.85	5.20	4.51	8.08
July	2.28	2.54	4.96	4.40	7.62
Aug.	2.25	2.49	5.00	4.38	7.54
Sep.	2.18	2.44	4.85	4.35	7.45
Oct.	2.10	2.32	4.74	4.33	7.33
Nov.	1.97	2.18	4.67	4.32	7.28
Dec.	1.89	2.07	4.68	4.32	7.31
1941 Jan.	1.99	2.16	4.60	4.29	7.15
Feb.	2.10	2.27	4.65	4.30	7.21
Mar.	2.02	2.28	4.64	4.26	7.20

(1) Aver. all U. S. bonds except those due or callable within 12 years.

(2) Standard Statistics Co.—Aver. 15 high-grade long-term municipal issues.

(3) Standard Statistics Co.—Aver. 15 high-grade industrials.

(4) Standard Statistics Co.—Aver. 15 high-grade public utility issues.

(5) Standard Statistics Co.—Aver. 15 high-grade rail issues.

New Construction Capital

(Millions of Dollars)

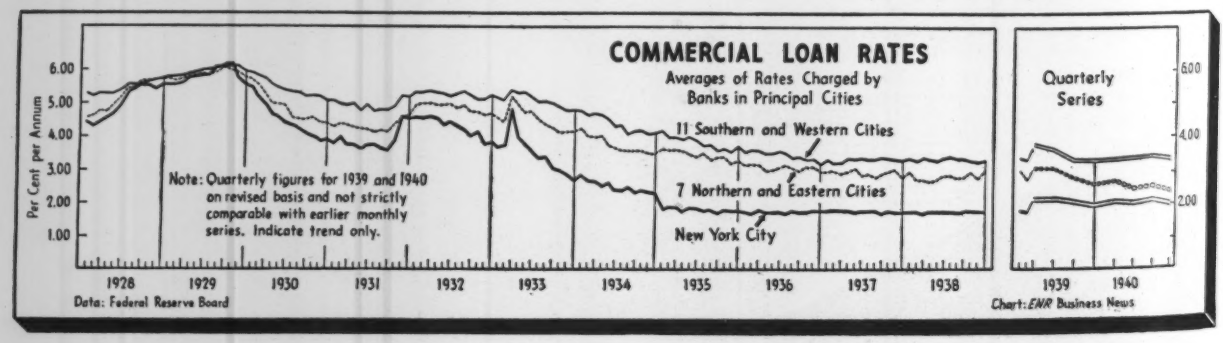
	Corporate	State and Municipal	Federal	Total
1925	$1,966	$1,352	.....	$3,318
1926	1,824	1,344	.....	3,168
1927	1,784	1,475	.....	3,259
1928	1,568	1,379	.....	2,947
1929	1,758	1,418	.....	3,176
1930	2,032	1,434	.....	3,466
1931	787	1,235	.....	2,022
1932	159	561	.....	720
1933	292	1,091‡	.....	1,383
1934	77†	1,011‡	$194	1,282
1935	47†	1,337‡	1,354	2,738
1936	251	698‡	691	1,640
1937	518†	738‡	946	2,202
1938	457†	1,902‡	1,345	3,704
1939	304†	783‡	1,318	2,405
1940	624†	805‡	2,466	3,895
1941*	127†	187‡	1,967	2,281

* First 15 weeks of 1941.

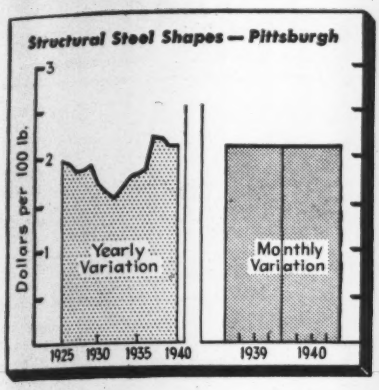
Note:— Federal appropriation include federal-aid highway, WPA, and regular departmental appropriations for construction.

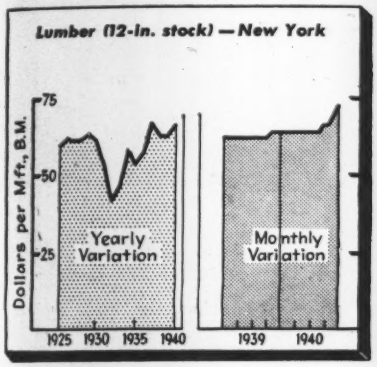
† Includes $237,000,000 RFC and PWA loans, '33; $55,000,000, '34; $9,000,000, '35; $807,000, '37; $76,106,000 REA, $4,500,000 RFC loans, '38; $89,000,000 REA and $400,000 RFC loans, '39; $40,000,000 REA and $193,000,000 in RFC loans '40; $25,870,000 in RFC loans, '41.

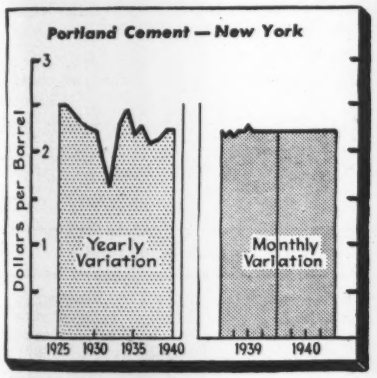
‡ Includes $814,000,000 RFC and PWA loans and grants, '33; $580,000,000, '34; $808,000,000, '35; $164,700,000, '36; $207,000,000, '37; $723,265,000 PWA, $99,844,000 RFC, $320,986,000 USHA loans, '38; $216,000,000 in USHA loans, '39; $219,000,000 USHA, $5,000,000 RFC loans in '40; $13,521,000 in USHA loans in '41.

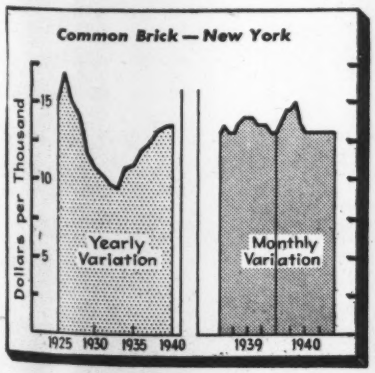


MATERIAL PRICE TRENDS MIXED









Prices of Construction Materials

CONSTRUCTION MATERIAL prices in New York revealed mixed trends during 1940. Long Leaf Yellow Pine opened at $64 per M ft., held at that level through August, then climbed to $72.50 by December. The net result was a 5 percent gain over the average reported for 1939 and a 13 percent increase over the price at the beginning of the year.

The quotations for structural steel shapes and portland cement in New York remained unchanged throughout the year. The 1940 average common brick price, $13.50 per M, was up 0.3 percent over 1939.

Basic Building Materials Prices

1874 to 1940 in New York City

Average yearly prices at New York, except in the case of steel, which is f. o. b. Pittsburgh mill; wrought-iron I beams for years 1879, 1885 and 1886. Brick, wholesale, f. o. b. Lime, common lump, wholesale, f. o. b., 180 lb., net, 1910–15, incl.; afterward, 280 lb. Cement, net, delivered; *Rosendale, 1874 to 1878, incl.*; afterward, Portland. Lumber, No. 1 com., rough, wholesale, at dock, for 1 in., yel. pine, 1874 to 1909, incl.; afterward, 3 in., long-leaf to 1913, incl. *LLYP-3 x 12 — from Lumber Trade Journal. †LLYP-12 x 12 as reported to Engineering News-Record. Cast iron pipe price per ton f. o. b. Delaware River foundries; *prices prior to 1901 are for all classes of bell and spigot*; prices subsequent to 1901 are for 6-in. and larger Cl. B or heavier bell and spigot; early prices from "Price History of Cast Iron Pipe" by United States Cast Iron Pipe and Foundry Co.; prices 1850, $35.72; 1855, $40.18; 1860, $32.15; 1865, $58.05; 1870, $50.

	Brick Common per M	Cement Per Bbl.	Lime Per Bbl.	Pine per M. Ft. b.m.		Steel Shapes, Per 100 Lb.	Cast Iron Pipe, Per Ton
1874	$7.41	*$1.48*	$1.50	$26.00		....	*$43.76*
1875	7.12	*1.25*	1.40	21.00		....	*37.51*
1876	5.87	*1.20*	1.00	21.00		....	*31.26*
1877	4.93	*1.10*	.80	20.00		....	*25.00*
1878	4.71	*.95*	.70	20.00		....	*23.22*
1879	4.08	2.70	.80	20.96		$2.78	*29.47*
1880	7.00	2.88	.87	19.00		....	*29.47*
1881	7.50	2.72	.95	19.00		....	*33.04*
1882	7.12	2.82	1.01	19.00		....	*35.68*
1883	8.28	2.75	1.05	19.00		....	*32.15*
1884	6.65	2.60	.95	19.00		....	*26.79*
1885	6.10	2.28	1.00	18.66		3.12	*25.00*
1886	7.51	2.28	1.00	19.00		3.00	*26.79*
1887	7.43	2.07	.82	19.00		....	*28.58*
1888	6.50	2.16	.83	16.75		....	*25.00*
1889	7.06	2.23	.92	20.31		....	*23.04*
1890	6.65	2.25	.95	21.75		....	*24.65*
1891	5.53	2.38	.87	18.00		....	*23.04*
1892	5.77	2.27	.93	18.50		....	*21.43*
1893	5.83	2.15	.93	18.50		....	*21.30*
1894	5.00	2.03	.85	18.50		1.20	*18.47*
1895	5.31	1.97	.78	16.92		1.35	*17.95*
1896	5.06	2.00	.69	16.42		1.60	*17.64*
1897	4.94	1.97	.72	16.44		1.24	*15.48*
1898	5.75	2.00	.70	15.75		1.27½	*15.48*
1899	5.69	2.05	.75	16.25		1.45	*21.17*
1900	5.25	2.16	.68	24.50		1.95	*22.33*
1901	5.77	1.89	.77	17.50		1.60	*21.63*
1902	5.39	1.95	.81	21.00		1.60	26.62
1903	5.91	2.03	.79	23.50		1.70	27.56
1904	7.50	1.67½	.80	21.50		1.60	22.92
1905	8.10	1.43	.89	24.92		1.62	26.54
1906	8.55	1.55	.95	29.33		1.60	30.12
1907	6.16	1.55	.95	30.50		1.75	31.52
1908	5.10	1.46	1.05	30.50		1.76	24.69
1909	6.39	1.41	1.05	33.04		1.50	24.19
1910	5.70	1.07	.75	24.00		1.46	22.99
1911	5.31	1.04	.75	24.63		1.36	19.99
1912	6.75	.97	.75	24.92		1.33	21.22
1913	6.75	1.18	.91½	* 25.04	†	1.50	21.96
1914	5.50	1.17½	.97	21.79	29.25	1.16	20.37
1915	5.50	1.00	.97	21.68	27.91	1.28	22.52
1916	8.00	1.32	1.50	27.60	31.58	2.45	30.25
1917	9.10	1.76	2.02	38.00	37.81	3.62	52.33
1918	10.98	2.48	2.16	46.68	43.33	3.00	58.68
1919	15.79	2.63	2.65	57.04	49.60	2.52	53.87
1920	18.00	3.52	3.15	71.17	66.50	2.45	71.77
1921	17.40	2.82	3.47	50.67	51.54	2.00	50.58
1922	16.91	2.43	2.79	49.41	51.83	1.70	46.42
1933	20.00	2.66	2.98	61.77	62.25	2.39	57.75
1924	18.00	2.50	2.88	55.17	59.00	2.19	54.33
1925	15.00	2.50	2.38	57.00	59.67	1.95	49.16
1926	17.00	2.50	2.18	60.33	62.17	1.93	48.50
1927	15.00	2.40	2.49	62.57	61.46	1.86	41.42
1928	14.00	2.30	2.30	63.33	61.34	1.87	35.92
1929	11.71	2.23	2.25	64.50	63.00	1.92	36.66
1930	10.88	2.19	2.25	64.33	60.64	1.71	37.00
1931	10.29	1.89	2.25	58.17	53.02	1.63	34.71
1932	9.75	1.62	2.25	39.91	41.33	1.56	30.58
1933	9.50	2.26	2.50	46.25	46.79	1.64	34.58
1934	10.87	2.48	2.50	57.17	58.92	1.78	41.00
1935	11.00	2.15	2.35	51.67	53.75	1.80	42.58
1936	12.00	2.26	2.80	56.75	57.75	1.84	43.00
1937	12.50	2.07	2.80	61.50	66.46	2.21	48.75
1938	13.10	2.12	2.80	59.33	62.75	2.18	48.33
1939	13.46	2.20	2.80	64.35	62.50	2.10	46.75
1940	13.50	2.20	2.68	67.39	65.46	2.10	49.00

INDEX NUMBERS OF WHOLESALE PRICES — BUREAU OF LABOR STATISTICS

(1926 = 100)	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931
Building materials	94.8	90.5	90.3	95.2	86.7	85.3	86.2	77.0	71.4	79.2
Brick and tile	90.5	91.4	91.0	93.5	88.7	89.4	90.2	79.2	77.3	83.6
Cement	90.8	91.3	90.3	89.0	92.2	92.7	93.1	88.1	74.3	74.8
Lumber*	102.9	93.2	87.4	99.7	87.0	81.1	84.5	70.7	58.5	69.5
Paint and paint materials	85.7	82.8	81.3	83.4	80.1	79.8	79.5	73.3	71.1	79.4
Plumbing and heating	80.4	79.2	78.5	78.8	75.0	68.9	72.6	67.1	66.8	84.7
Structural steel	107.3	107.3	111.0	113.2	95.0	92.0	90.8	83.1	80.9	83.1
Other building materials	93.3	90.3	92.7	99.1	90.2	90.1	90.3	82.7	79.5	84.8

* New Series

Materials and Labor Prices, December, 1940

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

LUMBER provides the only major change in the December construction material price list. Short Leaf Yellow Pine is $1.50 to $2.00 higher in Baltimore; up 50c. to $1.00 in Chicago; up $4.00 to $6.00 in Cincinnati; up $1.00 to $2.00 on most sizes in Dallas; up $1.00 in New York and St. Louis; up $12.00 to $15.00 in Pittsburgh; and 50c to $1.00 lower on 2-in. sizes in Birmingham.

Douglas Fir is $2.00 higher in Baltimore and Seattle; $1.00 higher in Boston; $1.00 higher on 1x6-in. size in Chicago; and up about $17.00 in Pittsburgh. Long Leaf Yellow Pine is off $2.00 on 2-in. boards in Birmingham. Spruce is up $1.00 in Boston, as is Native Pine in Denver.

The Seattle base price for form grade fir plywood remains unchanged, but many mills are out of the market.

Cement is 6c. per bbl. higher in Denver. Ready-mixed concrete is up 25c. per cu. yd. in Minneapolis due to a heating charge. Reinforcing bars are 10c. per 100 lb. higher in San Francisco for the only change in the construction steel list. Roofing material prices increased in Baltimore. Red lead is up 25c. per 100 lb. in all 20 cities.

Los Angeles carpenters new rate is $1.12½ per hour, an increase of 2½c. This is the only change in either the skilled or common labor rates for December.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT (Per bbl., carload lots, including 40c per bbl. for bags, cash discount not deducted)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE (Ready Mixed 1:2:4, 50 c.y. or more, delivered)
	Cloth Bags *a*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.90	$2.66	$2.61	$1.75	$1.85	$1.95	$1.65	$1.75	$1.55	$1.65	$7.90
Baltimore	2.31	2.06	1.86	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	6.75
Birmingham	2.50	2.25	2.05	1.75	1.75	1.50	1.00	1.00	.90	1.15	5.80
Boston	2.75*b*	2.50*b*	2.30	1.20‡	1.20‡	.90‡	1.20‡	1.20‡	....	....	6.75*m*
Chicago	2.60	2.35	2.20	2.00‡*d*	2.00‡*d*	2.00‡*d*	2.00‡*d*	2.00‡*d*	1.25‡	1.25‡	....
Cincinnati	2.58	2.33	2.08	1.20	1.20	1.10	1.80	1.80	....	....	6.60
Cleveland	2.60	1.75	....	1.45*i*	1.45*i*	1.30*i*	1.70*i*	1.70*i*	1.70*i*	1.70*i*	6.55*i*
Dallas	2.47	2.22	2.02	1.75*p*	2.00*p*	1.25*p*	1.69*p*	1.84*p*	....	....	6.20
Denver	3.08	2.83	....	1.20	1.40	.90	....	....	....	....	7.25
Detroit	2.24	1.99	1.79	1.55	1.65	.95	1.55	1.65	1.30‡	1.40‡	6.75
Kansas City	2.56	2.31	2.16	1.85	2.30	1.00	1.91	1.91	....	....	7.25*n*
Los Angeles	2.25*b*	2.05*b*	....	1.00	1.00	1.00	1.00*f*	1.00*f*	....	....	5.85
Minneapolis	2.90	2.65	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	7.60*j*
Montreal	....	1.82*r*	1.67*r*	....	....	1.25‡	.85‡*e*	1.00‡*e*	....	....	6.45*k*
New Orleans	2.41	2.16	1.96	1.50	1.50	1.25	....	....	....	....	7.25
New York	2.60‡	2.35‡	....	1.25‡*e*	1.25‡*e*	.75‡*e*	1.65‡*e*	1.75‡*e*	....	....	6.50
Philadelphia	2.32	2.07	1.87	1.55‡	1.65‡	1.25‡	....	....	1.00	1.00	7.95*h*
Pittsburgh	2.44	2.19	1.99	1.40‡	1.40‡	1.70‡	2.25‡	2.25‡	1.50	1.50	7.50
St. Louis	2.55	2.30	....	1.50‡	1.50‡	1.25/1.50‡	.90*h*	.90*h*	.75*g*	.75*g*	7.50
San Francisco	2.16	1.96	1.66	1.36	1.36	1.36	1.46	1.46	....	....	6.95
Seattle	2.95*e*	2.70*e*	....	1.00*e*	1.00*e*	1.00*e*	2.00*e*	2.00*e*	....	....	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Plus municipal tax. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount 35c. 500 to 2000; 70c. 2000 to 5000; 95c. over 5000. *l* Up to 200 cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash 15 days. *r* 10c. per bbl. off, cash 20 days.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.70	$1.65	Ironton, Ohio	$1.60	$1.55	Richard City, Tenn.	$1.80	$1.75
Dallas, Tex. (Inc. 5c. tax)	1.80	1.75	Limedale, Ind.	1.70	1.65	Steelton, Minn.	1.80	1.75
Hannibal, Mo.	1.70	1.65	Norfolk, Va.	1.65	1.60	Universal, Pa.	1.65	1.60
Hudson, N. Y.	1.75	1.70	Northampton, Pa.	1.55	1.50	Waco, Tex. (5c. tax in Tex.)	1.75	1.70
Independence, Kans.	1.70	1.65	North Birmingham, Ala.	1.70	1.65	Montreal	1.55	1.55

PAVING BRICK, BLOCKS, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICKS AND BLOCKS			PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80-300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OILS (Per gal.)	ASPHALT EMULSION (Quick-breaking) (Per gal.)	
	Granite per M. lots of 50,000 4x4x8 in.	Brick per M. 3¼x4x8⅛ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$17.30*e*	$23.83*e*	$0.0695*e*	$0.1018*e*	$0.0734*he*	$0.1257*h*	$0.0634*e*	$0.0734	$0.1257
Baltimore	150.00‡	45.00‡	2.75	14.00	20.00	.06	.09	.065*h*	.115*h*	.....	.....	.....
Birmingham	.....	27.50/‡	....	18.20	23.20	.0747	.1047	.0834*h*	.1484*h*	.....	.....	.....
Boston	90.00	47.50	3.25	14.00	20.00	.06	.09	.065*h*	.115*h*	.....	.09‡	.12‡
Chicago	140.00	50.00	1.80*d*	14.50	18.50	13.00*g*	17.00*g*	.06*h*	.09*h*	.04	.09	.125
Cincinnati	112.00	37.50	....	13.50	17.50	.07	.....	16.80	.....	.0525	.....	.075
Cleveland	110.00	37.50	2.80	15.50	20.50	.065	.075	.075*h*	.085*h*	.0375	.08	.09
Dallas	.....	30.00	....	13.25	20.30	.06	.103	15.00	24.80	.055	.05/.07	.07/.09
Denver	.....	27.50	....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	35.00	....	13.15/	18.45/	.061	.0984	13.15	17.20	.0475	.061	.0923
Kansas City	.....	40.00	....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	....	6.50*b*	15.00	6.50*bg*	15.00*bg*	5.50*b*	.....	.0192	.0525	.1125
Minneapolis	.....	.....	1.90*d*	19.20	24.20	.10	.12	19.30	28.30	.056	.....	.....
Montreal	75.00	.....	3.62	16.60	24.25	.116	.1455	.115*h*	.135*h*	.08	.135	.185
New Orleans	.....	.....	....	14.00*a*	19.00*a*	.055	.085	.06*h*	.09*h*	.....	.078	.....
New York	.....	.....	2.80	15.00	21.00	.06	.09	.065*h*	.115*h*	.....	.07	.11
Philadelphia	120.00	42.50	2.84	14.00	19.00	.055	.08	.06*h*	.09*h*	.05	.06	.09
Pittsburgh	135.00	38.75	....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis	110.00/121.00	37.00	....	14.00	19.00	14.00*g*	19.00*g*	.06*h*	.095*h*	.04	.09	.125
San Francisco	.....	70.00	....	6.50	15.00	6.50*g*	15.00*g*	7.00	17.50	.025	.0525	.1125
Seattle	.....	60.00*e*	....	14.70	24.10	.....	24.10*g*	9.50/10.50	23.00/24.00	7.75*g*	.0575*h*	.1308*h*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8⅛ in. *d* 2½ in. 6 to 8-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3x3⅝x8½ in.

Pozzolith Used In Atchison, Topeka & Santa Fe Railroad Bridge, Chicago, Illinois. Private Plans. Contractors — Great Lakes Dredge & Dock Company, Chicago, Illinois.

POZZOLITH

lies the new principle of Cement Dispersion to Portland ent, and is making better, more durable, more watertight crete, by attacking the big cause of leakage and porosity xcess water in the mix. Pozzolith reduces the amount of er required for easy placing from 15% to 20%.

POZZOLITH also speeds the job by making the placement h easier and faster, particularly around steel reinforcing. uced water results in far less segregation and honey-bing, a costly factor in the transportation of "pumpcrete" "ready-mix". Shrinkage and porosity are sharply reduced.

POZZOLITH cuts concrete costs as a result of easier and ter placeability at the specified water ratio and slump.

Thousands and thousands of yards of concrete are now g placed on Defense Projects with Pozzolith — saving and money for the contractor and assuring better ctures for the owner.

POZZOLITH has behind it a successful performance record n years. Ask for details.

THE MASTER BUILDERS COMPANY

ZLAND, OHIO — TORONTO, CANADA

HOW POZZOLITH WORKS

Cement particles in their normal state in water tend to gather together in bunches; i. e., flocculate. This bunching also entraps water within the particle clumps. (See cut at left).

With Master Builders' dispersing agent these bunches are broken up into individual cement particles distributed through the water; i. e., dispersed or deflocculated. (See cut at right).

This dispersion makes the cement usable to its full efficiency; all the cement surface is made available for hydration and all the water for lubrication of the mix. (Water held within the particle clumps is released).

The results are:—

Greater workability with less water.
Increased strength.
Watertightness.
Durability (Resistance to freezing, thawing, and corrosion.)

The complete story of "Cement Dispersion" will be sent on request. Ask for Research Paper No. 35.

Pozzolith is made in two types: Type 1 — Regular Pozzolith produces normal strengths at early ages and normal finishing operations; Type 2 — High Early Pozzolith gives all Regular Pozzolith values *plus high early strengths*, an increase in compressive strength over untreated cement mix of same design and consistency, as follows:

at 1 day — 100% increase
3 days — 75% increase
7 days — 50% increase
28 days — 25% increase

MASTER BUILDERS

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ½-in. billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle Bars	Std. Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.10	$2.15	$3.40	$2.55	.....	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15	$4.15
Chicago	2.10	2.15	3.40	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.15
Pittsburgh	2.10	2.15	3.40	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.15
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15	.....
Cleveland	2.10	2.15	3.40	2.55	.....	.....	.....	.....	.....	.....	.....	.....
Youngstown	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....	.....
Detroit	.....	2.25‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gulf ports	2.45*a*	2.40*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....	.....
Pacific ports	2.75*a*	2.50*a*	.....	.....	2.95*a*	.....	.....	.....	.....	3.00	2.30	.....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per c.l. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates, alone,

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¾ in., base price 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH—WELDED FABRIC REINFORCING —Per 100 sq.yd.. carload lots— Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	—Per 100 s.f.. carload lots— 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6 & 6 wires Per sq. yd.	SHEET PILING Per 100 lb. base price
Atlanta	$2.34	$2.39	$2.14	.02½	.10	$21.00	$23.00	$1.82	$1.35	$0.1719	$3.04
Baltimore	3.70	2.90	2.75	.....	.10	24.00	26.00	1.70	1.27	.1611	2.90
Birmingham	2.10*a*	2.15	2.15	.02½	.10	20.50	22.50	1.80	1.34	.1701	....
Boston	3.85	2.61	2.46	$20 C.L.	.10	21.50	23.50	1.76	1.31	.1656	3.14
Chicago	2.10*a*	2.15	2.05	.03	.05	19.50	21.50	1.67	1.25	.1575	2.40
Cincinnati	3.68	2.46*c*	2.36*c*	.....	.05	20.50	22.50	1.66	1.25	.1566	....
Cleveland	3.58*g*	2.15	2.05	.02½	.10	22.50	23.50	1.66	1.25	.1566	....
Dallas	4.60	3.25	3.25	.....	.....	22.50	24.50	1.93	1.42	.1827	....
Denver	4.35	3.95	3.80	.....	.....	23.50	25.50	1.97	1.45	.1863	....
Detroit	3.60‡	2.25	2.15	.....	.10	22.50	24.50	1.68	1.26	.1584	2.66
Kansas City	4.00	2.51*c*	2.36*c*	.0	.05	15.50	19.00	1.78	1.33	.1683	2.86
Los Angeles	3.65*f*	2.25	2.10	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.65
Minneapolis	3.80‡	2.48*c*	2.33*c*	.0	.10	19.50/20.50	21.50/22.50	1.80	1.34	.1701	2.73*d*
Montreal	.....	.....	.....	.....	.....	26.50	29.00	2.99	2.08	.319	....
New Orleans	4.40	2.52	2.52	.05	.10	21.50	23.50	1.82	1.35	.1719	2.87*5*
New York	3.75	2.39	2.29	.....	.10	14.50	16.50	1.76	1.32	.1665	2.74
Philadelphia	3.55	2.66	2.56	.....	.....	19.50	21.50	1.71	1.28	.1611	2.72
Pittsburgh	2.10*a*	2.15	2.05	.02½	.10	21.50	24.50	1.59	1.20	.1503	2.40
St. Louis	3.47	2.39	2.29	.0	.05	24.00	28.00	1.69	1.27	.1602	2.70
San Francisco	3.35	2.50	2.35	.02½	.10	19.00	25.50	1.93	1.42	.1827	3.25
Seattle	2.75*e*	2.50*e*	.....	.....	.....	25.50	27.50	1.93	1.42	.1827	2.95*e*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 30c.; 1 to 5 tons, add 10c. High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	delivered std. 12 in., s.s.	ASTM 24 in.,	C13–35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14–35 24 in.	WROUGHT STEEL PIPE Full standard weight, *h* 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6in.; Lap Weld Black %	Galv. %
Atlanta	$49 40	$0.26*b*	$0.468*bc*	$1.8525	$4.68*c*	$85.00	$128.00	$0.45	$1.642	62.2	54.2	59.7	51.2
Baltimore	52.80	.35	.60	2.30	6.80	115.00	150.00	.50	1.75	65.5	57.5	63.00	54.5
Birmingham	45.00	.26	.468	1.7875	4.66	85.00	220.00	.40	1.60	62.2	54.2	59.7	51.2
Boston	55.00	.231	.4455	1.89	5.2275	180.00‡	280.00‡	.50	2.30	64.1	56.1	61.6	53.1
Chicago	53.80	.28	.54	2.25	6.25	100.00‡	150.00‡	.38	1.48	67.0	59.0	63.5	55.0
Cincinnati	52.70	.245	.4995	1.9335	5.6375	105.00	170.00	.60	1.70	65.9	57.9	63.4	54.9
Cleveland	54.24	.196	.378	1.485	4.51	69.00	108.00	.35	1.50	67.8	59.8	65.3	56.8
Dallas	58.20	.28	.504	2.016	4.70	80.00	100.00	.46	1.57	59.9	51.9	57.3	48.3
Denver	60.60	.24†	.52†	2.16†	.....	130.00	240.00	....	....	58.4	50.4	55.7	47.2
Detroit	54.24	.245	.4725	1.935	4.408	66.45	105.00	.33	1.50	66.3	58.3	63.8	55.3
Kansas City	55.12	.30	.54	2.16	5.00	120.00	240.00	.45	1.60	62.9	54.9	60.0	51.5
Los Angeles	55.00	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	59.6	51.6	57.0	48.6
Minneapolis	57.20	.24†	.432†	1.728†	4.60†	.....	.....	.70	1.80	64.2	56.2	60.7	52.2
Montreal	60.00	.55	.90	3.68	5.95*e*	135.00‡	260.00‡	.48	1.92	.....	.....	.....	....
New Orleans	51.38	.26	.48	1.69	.....	150.00	220.00	.37	2.10	62.4	54.4	58.8	50.3
New York	52.20	.32	.63	2.52	6.45	.....	.....	.50	1.20	64.9	56.8	62.4	53.9
Philadelphia	50.90	.....	.....	.....	.....	.....	.....	.54	1.80	65.3	57.3	62.8	54.3
Pittsburgh	55.60	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*g*	2.00*g*	68.5*i*	60.5*i*	66.0*i*	57.5*i*
St. Louis	52.48	.24	.432	1.728	3.96	85.00	170.00	.75*j*	1.80*k*	65.1	57.1	62.0	53.5
San Francisco	55.00	.3275*d*	.5895*d*	2.358	5.895	107.25	178.75	.54	2.50	.....	.....	.....	....
Seattle	55.35	.35	.63	2.52	6.30	72.00	175.00	.35*f*	1.30*f*	.....	.....	.....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N.J. (base) $49.00. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ¼ in., 8½c.; ⅜ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest ptice at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 19; 1½ in. black 38, galv. 21½; 2 in. black 37½, galv. 21. Lapweld—2½ in. to 3½ in. black 31½, galv. 17½ in.; 4½ in. to 8 in. black, 32½ galv. 20. *j* Reinforced; spec. C 76-37. *k* Reinforced; spec. C 75-37.

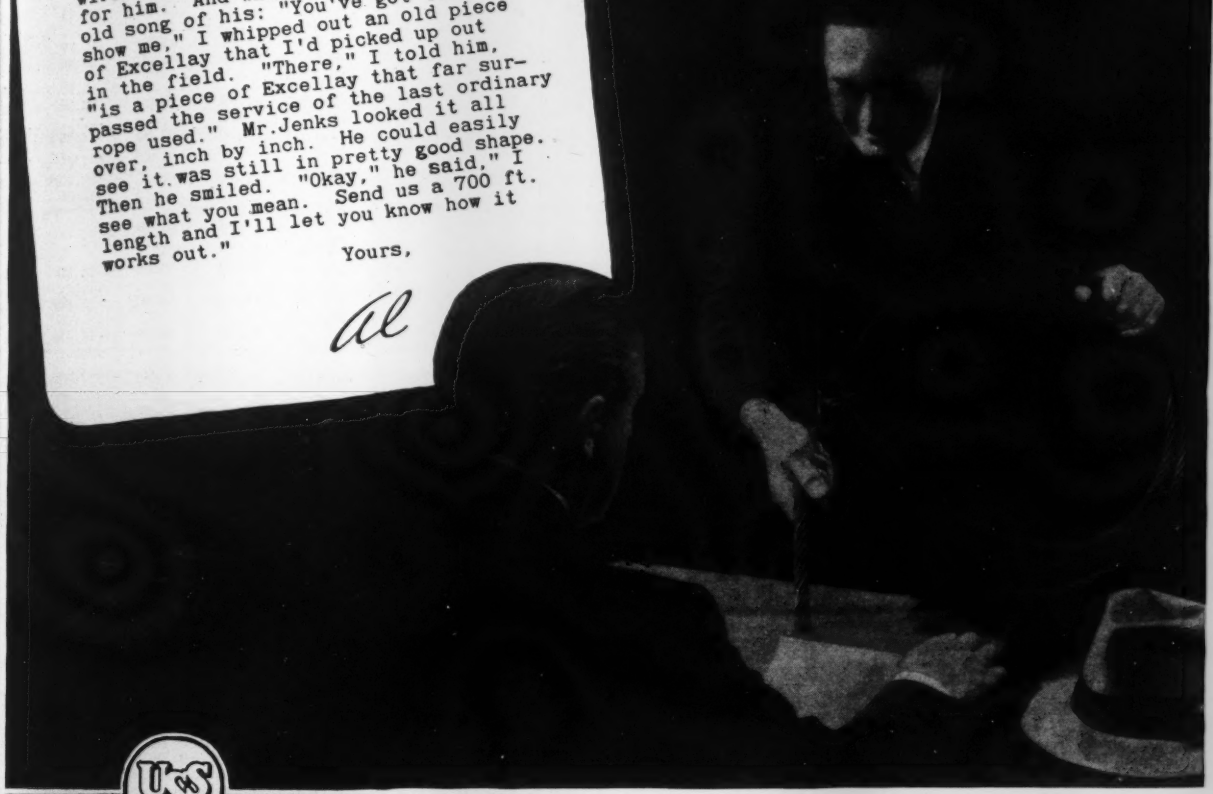
FROM THE DAILY REPORT OF A
TIGER BRAND WIRE ROPE ENGINEER

Mr. Jenks is one of those "I'm from Missouri" fellows. For years he's been pooh-poohing the idea that there's any real difference between wire ropes. But today I was ready for him. And when he went into that old song of his: "You've got to show me," I whipped out an old piece of Excellay that I'd picked up out in the field. "There," I told him, "is a piece of Excellay that far surpassed the service of the last ordinary rope used." Mr. Jenks looked it all over, inch by inch. He could easily see it was still in pretty good shape. Then he smiled. "Okay," he said, "I see what you mean. Send us a 700 ft. length and I'll let you know how it works out."

Yours,

al

THEN I WHIPPED OUT AN OLD PIECE OF EXCELLAY



USS

EXCELLAY
Preformed
WIRE ROPE

OUR engineers keep in constant touch with wire rope users in every industry. They believe that they can serve you best by seeing just how and where you use wire rope, taking down notes on how to prolong rope life so that they can give you money-saving tips. Whenever you're not fully satisfied with the performance of wire rope in any application, be sure to tell one of these engineers about your problem. Circumstances, of course, govern how much can be accomplished to save you money through better wire rope performance, but of this you can be sure: The American Tiger Brand Wire Rope Engineer will not consider his job finished until he has solved to your satisfaction every problem involved in your use of wire rope.

AMERICAN STEEL & WIRE COMPANY
Cleveland, Chicago and New York

COLUMBIA STEEL COMPANY
San Francisco

United States Steel Export Company, New York

UNITED STATES STEEL

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

SHORT LEAF YELLOW PINE AND DOUGLAS FIR

All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)

All Fir planks No. 2 common. Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)

	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 R2k	6x12 R2k	12x12 R2k
Atlanta	$32.00	$32.00	$27.00	$28.50	$28.50	$32.00	$34.50	.....	.....
Baltimore	37.00	38.50	38.00	39.00	39.00	40.00	52.00	.....	.....
	39.00	*39.00*	*41.00*	*40.00*	*40.00*	*39.00*	*52.00*	*$52.00*	*$52.00*
Birmingham	34.00	34.00	31.00	31.00	31.50	32.00	42.00	42.00	51.00
[1]	38.00	38.00	35.00	35.00	36.00	36.00	58.00	.....	.....
Boston	34.00[2]	34.00[2]	37.00[2]	37.00	57.00[1]	62.00[1]	80.00[1]	.....	.....
	35.00	*35.00*	*37.00*	*37.00*	*40.00*	*40.00*	*49.00*	*49.00*	*49.00*
Chicago	42.00	42.00	38.00	38.00	37.00	42.50	52.00	.....	.....
	40.00	*40.00*	*40.00*	*40.00*	*40.00*	*42.00*	*45.00*	*45.00*	*45.00*
Cincinnati	37.50	39.00	35.00	35.00	36.00	41.00	50.00	.....	.....
	.....	.....	.....	.....	.....	.....	*52.00*	*52.00*	*52.00*
Cleveland	38.50	40.00	40.00	38.00	36.00	42.00	49.00	49.00	49.50
Dallas *a*	38.00	39.00	38.00	36.00	37.00	38.50	52.50	52.50	52.50
Denver ‡	46.00[4]	44.00[4]	48.00[4]	47.00[4]	47.00[4]	49.00[4]	48.00[4]	58.00[4]	65.00[4]
Detroit	42.00	42.00	40.00	42.00	42.00	44.00	51.00	.....	.....
	.....	.....	.....	.....	.....	*49.00*	*52.00*	*59.00*	*59.00*
Kansas City	40.00	41.00	37.50	37.50	37.00	37.50	40.00	.....	.....
	37.50	*37.50*	*38.50*	*38.00*	*38.00*	*37.50*	*40.00*	*43.00*	*43.00*
Los Angeles *a*	*40.00*	*40.00*	*39.00*	*39.00*	*36.00*	*36.00*	*43.00*	*43.00*	*43.00*
Minneapolis ‡*b*	40.00[3]	40.00[3]	.....	.....	.....	.....	.....	.....	.....
‡	*42.00*	*42.00*	*42.00*	*40.00*	*40.00*	*42.00*	*44.50*	*53.50*	*53.50*
Montreal †[7]	*54.00*	*56.00*	*52.00*	*54.00*	*56.00*	42.00	45.00	.....	.....
	52.00	*54.00*	*52.75*	*55.75*	*57.75*	*60.75*	*52.00*	*52.00*	*52.00*
New Orleans	24.00	25.00	25.00	24.00	24.00	25.00	46.00	.....	.....
	29.00	*29.00*	*32.00*	*33.00*	*35.00*	*34.00*	*36.00*	.....	.....
New York ‡	48.00	49.00	43.00	45.00	45.00	46.00	48.00	.....	.....
‡	.....	.....	*50.00*	*50.00*	*50.00*	*50.00*	*50.00*	*52.50*	*52.50*
Philadelphia	24.00	24.50	25.50	25.50	27.50	27.50	29.00	.....	.....
	35.00	*36.50*	*39.00*	*38.25*	*29.00*	*39.00*	*44.00*	*32.00*	*32.00*
Pittsburgh	50.80	53.20	62.75	55.00	60.85	62.50	76.25	.....	.....
	69.20	*68.10*	*66.10*	*68.30*	*65.20*	*65.65*	*88.75*	*88.75*	*88.75*
St. Louis ‡*c*	42.00	42.00	38.00	37.00	38.00	39.00	50.00	*58.00*	*58.00*
San Francisco *d*	*28.00*	*27.00*	*28.00*	*29.50*	*29.00*	*29.50*	*29.50*	*28.00*	*28.00*
Seattle	*25.00*	*25.00*	*25.00*	*25.00*	*25.00*	*25.00*	*32.00*	*32.00*	*32.00*

	LONG LEAF Y. P. Merchantable grade up to 20 ft. 2x12 R2k	12x12 R2k	PLYWOOD* Rail freight increment (See note for base prices) 1/4"	3/8"
Atlanta	$47.00	$57.00	$17.75	$21.90
Baltimore	74.00	76.00	17.35*g*	21.15*g*
	.....	.....	.....	.....
Birmingham	.....	.....	16.25	19.85
	55.00	58.00	.....	.....
Boston	80.00	80.00	17.35*g*	21.15*g*
	.....	.....	.....	.....
Chicago	90.00	100.00	13.80	16.80
	.....	.....	.....	.....
Cincinnati	60.00	63.00	16.25	19.85
	.....	.....	.....	.....
Cleveland	82.50	82.50	16.70	20.40
Dallas *a*	76.00	81.00	13.90	16.95
Denver ‡	.....	.....	9.90	12.05
Detroit	50.00	59.00	16.25	19.85
	.....	.....	.....	.....
Kansas City	65.00	70.00	12.25	14.95
	.....	.....	.....	.....
Los Angeles *a*	.....	.....	9.35*gh*	11.35*gh*
Minneapolis ‡*b*	.....	.....	12.05	14.70
‡	.....	.....	.....	.....
Montreal †[7]	155.00	165.00	.....	.....
	.....	.....	.....	.....
New Orleans	62.00	69.00	13.90	16.95
	.....	.....	.....	.....
New York ‡	82.50*f*	85.00*f*	17.35*g*	21.15*g*
‡	.....	.....	.....	.....
Philadelphia	50.00	57.50	17.35*g*	.1512*g*
	.....	.....	.....	.....
Pittsburgh	.....	.....	17.00	20.70
	.....	.....	.....	.....
St. Louis ‡*c*	76.00	75.00	13.90	16.95
San Francisco *d*	.....	.....	7.30*g*	8.90*g*
Seattle	.....	.....	0.00	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [6] Spruce. [7] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* At ship's tackle. *e* 10% discount taken off. *f* Up to 18 ft. † Montreal prices stabilised for balance of year by order of Dominion Controller of Lumber.

NOTE: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface measure, Seattle base price on 1/2", $81.60; on 3/4", $89.90; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M. *Many mills out of market due to rush of defense orders. *g* Lower rate by water shipment. *h* 50,000 lb. minimum.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS Discounts from jobbers list, Aug. 15, 1938 Single or Double Thickness A quality	B quality	EXPLOSIVES Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*
Atlanta	75%	75%	$0.15
Baltimore	82%	81%	.15
Birmingham	75%	75%	.105
Boston	82%	82%	.15
Chicago	79%	79%	.15
Cincinnati	77%	77%	.15
Cleveland	79-10-10%	79-10-10%	.205
Dallas	78%	78%	.165
Denver	77%	77%	.15*e*
Detroit	79-10%	79-10%	.15
Kansas City	77-10%	77-10%	.165
Los Angeles	86%*d*	88%*d*	.1575
Minneapolis	76%	76%	.16
Montreal	.....	.....	.17†
New Orleans	70%	75%	.16
New York	81%	82%	.22*f*
Philadelphia	82-10%*d*	83-10%*d*	.15
Pittsburgh	79%	79%	.1425
St. Louis	77-10%	77-10%	.155
San Francisco	78%*d*	83%*d*	.155
Seattle	85%*d*	88%*d*	.1575

Price of 60% Ammonia Gelatin is $0.015 per lb. higher than 40%

a Disc. from list Sept. 1939. *b* Also less 6% tax exemption. *d* Discount from jobbers' list Sept. 15, 1928.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal Street, add delivery charge of $6.00 per trip. † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla	$0.105	$0.14	$0.16
W. of Miss. to Rocky Mtn. States, and Fla	.11 -.12	.135 -.15	.155 -.17
Rocky Mtn. States	.11 -.1325	.13 -.145**	.15 -.165**
Pacific N. W. States	.1075-.115	.1375-.15	.1575-.17
Pacific S. W. States	.1050-.1175	.135 -.1475	.155 -.1625

** F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES—F.O.B.

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered from barge 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short Leaf Barge	Short Leaf Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.18	$0.195
12 in.— 2 ft. from butt	6 in.	50 to 59 ft.	.225	.24[1]
12 in.— 2 ft. from butt	6 in.	60 to 69 ft.	.23	.255
14 in.— 2 ft. from butt	6 in.	50 to 69 ft.	.24	.265
14 in.— 2 ft. from butt	6 in.	70 to 79 ft.	.28	.275
14 in.— 2 ft. from butt	5 in.	80 to 85 ft.	.40	.415
14 in.— 2 ft. from butt	5 in.	85 to 89 ft.	.42	.432

RAILWAY TIES

Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.20	....	$1.65	....
	Pine	1.50	$2.25*a*	2.25	$3.20*a*
New York	S. L. Sap Pine	1.20/1.30	1.95	1.60	2.45
	Mixed Oak	1.55	2.05	2.00	2.55
Birmingham	White Oak	.85	1.50*a*	1.35	1.70*a*
	Southern Pine	.55*b*	1.10*ab*	.70	1.30*a*
Chicago	Oak	....	1.65*a*	....	2.25*a*
	Southern Pine	....	1.53*a*	....	2.13*a*
Los Angeles	Douglas Fir	.64	1.38*a*	.90	1.80*a*
Philadelphia	Red Oak	1.10	....	....	2.40*a*
St. Louis	White Oak	1.12	....	1.50	....
	Red Oak	1.12	1.60*a*	1.50	2.05*a*
	Sap Pine or Cypress	1.02	....	1.40	....
San Francisco	Douglas Fir	1.00*bef*	....	....	2.45*ef*
Montreal	Birch or Maple	.65	1.05*a*	.75	1.35*a*

Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 6" x 8" x 8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* At ships tackle.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb	$2.00-2.85
Chlorine cylinders, liquid, per lb. delivered	.0525
Calcium chloride, 77-80%, flaked, in 400-lb. drums or 100-lb. moisture proof bags, delivered, per ton	20.50-35.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.10
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00
Sulphate of copper, in bbl., per 100-lb	4.75

DU PONT EXPLOSIVES

help drive the new Continental Divide Tunnel

Under the mountains from the east and west sides, men are working day and night to construct this tunnel, which is reported to be the longest one ever attempted without shafts. When completed, it will be circular in section, 9¾ feet in diameter, with a gradient of 8⅓ feet per mile.

ABOVE: The east portal of the tunnel.
BELOW: The heading of the tunnel, after loading and wiring operations are completed and ready for the blast.

Listen to "Cavalcade of America" . . . presented by Du Pont every Monday evening over coast-to-coast NBC Red Network

Probably longest tunnel ever attempted without shafts

THE PROBLEM: Just east of the Rockies lies an area capable of raising a $31,000,000 annual crop, plus a good income from livestock. But this can only be accomplished with abundant moisture, and the nearest adequate water supply is on the other side of the Rockies.

THE ANSWER: The new Continental Divide Tunnel, which will divert water from the western side of the Rockies to the eastern.

Boring thirteen miles of solid rock under the Continental Divide, this tunnel will be probably the longest ever attempted without shafts . . . a major engineering project supplying water to irrigate a huge area, and to generate electric power.

The eastern sections of the tunnel are being driven by S. S. Magoffin, Inc., Englewood, Colorado. Platt-Rogers, Inc., Pueblo, Colorado, has the contract for a western section. To both of these well-known firms, Du Pont extends congratulations for the swift, smooth progress already made.

GELEX was specified because this increasingly popular dynamite offers economy combined with utmost efficiency. GELEX is semi-gelatinous, plastic and cohesive. Its high velocity gives excellent fragmentation, helps speed mucking out. Its minimum fumes permit a quicker return to the working face. And its good water resistance means that this economical explosive may often be used in place of the more expensive gelatins.

Du Pont All-Metal Delay Electric Blasting Caps were selected because of their *proved* dependability of performance.

If *you* have a blasting problem, Du Pont stands ready to help you. By supplying you *promptly* with proved explosives and giving technical assistance, we help you do the job in the shortest time at the lowest cost.

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Explosives Department **Wilmington, Delaware**

DUPONT EXPLOSIVES *and* BLASTING ACCESSORIES

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE — PARTITION — SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity. Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carload lot, Pulverized or lump
Atlanta	$90.00	$100.00	$185.00	$220.00	$230.00	$240.00	$12.50	$16.00	$26.50	$17.00	$17.00
Baltimore	75.00	80.00	150.00	180.00	225.00	280.00	14.00*k*	17.00*k*	18.50	15.00	2.50*m*
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	13.50	16.50	18.11	12.64	1.66*m*
Boston	95.05*a*	101.40*a*	190.05*a*	215.35	279.20*a*	319.10*a*	17.00*i*	20.00*i*	21.00	14.00	18.00*l*
Chicago	68.10	72.60	135.90	185.70	234.90	268.10	11.00	12.00	16.40	14.40	12.20
Cincinnati	61.4*C*	65.30	121.90	141.50	187.30	215.20	16.00	16.00	15.90	13.00	.....
Cleveland	56.50	60.00	112.50	135.00	182.50	209.00	16.00	16.00	15.00*j*	12.00*j*	2.75*m*
Dallas	62.50	67.00	135.00	162.00	177.00	263.00	11.50*i*	13.50*i*	19.00	15.00	.95*m*
Denver	84.80	94.40	152.70	178.20	212.00	227.90	13.50	17.00	28.00*j*	17.00*j*	35.00*j*
Detroit	69.00	73.60	138.00	176.00	232.00	265.00*e*	16.00	17.00	16.00	13.75	14.75
Kansas City	64.50	66.50	86.00*c*	125.50	159.75	186.25	14.25	24.00	19.10	12.80	10.70
Los Angeles	73.50†*r*	89.50†*r*	128.00*c*†*r*	210.00†*r*	368.00†*r*	460.00†*r*	13.50	15.00	16.50	.....	17.50
Minneapolis	71.45	76.20	143.95	171.45	173.80	242.10	13.10	15.10*g*	21.00	16.00	19.00
Montreal	72.20*a*	77.50*a*	142.50*a*	76.00*a*‡	165.80*a*	248.70	20.75	28.00	23.50	17.00	12.00
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
New York	87.00	93.00	128.00*c*	193.30*h*	238.80*h*	295.60*h*	13.00	.....	19.00	14.00	1700
Philadelphia	80.50	85.90	161.10	193.30	238.80	295.60	15.50*s*	18.00*s*	15.50*q*	9.55*q*	12.05*q*
Pittsburgh	58.40	62.40	116.85	124.00	153.00	193.75	17.00	25.00	17.90	15.40	2.55*m*
St. Louis	62.00	88.00	120.00	180.00	234.00	280.00	16.00	17.00	22.00	16.00	2.30*m*
San Francisco	84.00	94.50	225.00	.....	.....	.....	14.00	17.00	.55*o*	.40*o*	2.05*m*
Seattle	100.00	110.00	220.00	.....	.....	.....	17.50*f*	17.50*f*	20.00*s*	20.00*s*	20.00*s*

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in. *d* Not load bearing. *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days. *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* 50c. per M. off for cash. *j* LCL. *k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 180 lb. *n* Per sack 100 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *q* 25-ton cars. *r* 5% discount 10 days. *s* 2% off cash. *t* 5½ x 8 x 12.

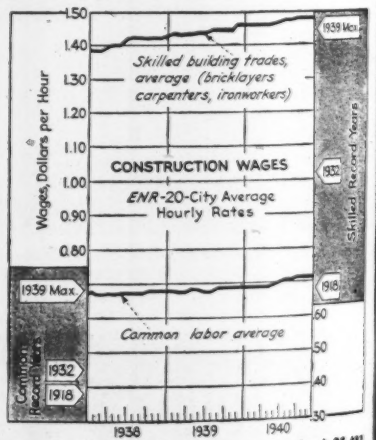
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in oil	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *c*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85-90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$9.50	$13.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.00
Baltimore	9.25	12.75	1.75	2.50	2.00	2.40	2.95	2.95	.55	29.00
Birmingham	9.50	13.125	2.35	2.75	1.85	1.98	1.57	1.57	.32	27.00
Boston	9.25	12.75	1.85‡	2.50‡	1.80‡	1.80‡	1.85*h*‡	1.85*h*‡	.50‡	26.00‡
Chicago	9.25	12.75	1.96	2.63	1.68	1.45*h*/*f*	1.50*h*/*f*	1.50*h*/*f*	.26/*f*	22.00/
Cincinnati	9.25	12.75	1.65	2.85	1.55	2.40	2.39*h*	2.39*h*	.36	21.00
Cleveland	9.25	12.75	1.90	2.60	1.60	1.75	1.50*h*	1.50*h*	.35	21.00
Dallas	9.25	13.50	1.88	2.11	....	2.75*h*	2.60*h*	2.70*h*	.275	34.00
Denver	9.75	13.25	1.65	2.40	.17*l*	2.45	4.00	3.00	.35	18.00
Detroit	9.25	12.75	1.75	2.75	1.25	2.40	2.50	2.50	.35	26.00
Kansas City	9.25	12.875	2.15*g*	2.40*g*	1.67*g*	1.93	2.09	2.09	.25	25.00
Los Angeles	9.50	13.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	9.25	12.875	....	....	....	1.75*i*	1.50*h*/*i*	1.50*h*/*i*	.29	21.00
Montreal	9.25	9.00	2.25	2.80	2.35	2.53	1.68	1.78	.70	1.68*k*
New York	9.25	12.75	1.88	2.55	1.60	1.75	1.50*h*	1.50*h*	.23	24.00
Philadelphia	9.25	12.75	....	....	....	1.92*e*	1.99*h*/*e*	1.99*h*/*e*	.41*e*	21.00
Pittsburgh	9.25	12.75	1.05	1.95	.80	1.95	1.94*h*	1.94*h*	.34	26.00
St. Louis	9.25	12.75	1.90/2.00	2.60/2.80	1.60/2.00	2.04	1.50	1.50	.24	21.00
San Francisco	9.50	13.00	1.80	2.75	1.10/2.00	1.65	2.26	2.26	.28	17.00
Seattle	9.50	13.25	1.80	2.60	....	1.81	1.30/2.00	1.75	.35	28.00*j*

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per 100 lb. *l* Per lb.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor — Building	Common Labor — Heavy Const.
Atlanta	$1.25	$1.00	$1.375	$1.00/1.25	$1.25	$0.40/.50	$0.40/.50
Baltimore	1.50	1.25	1.65	1.50	1.375	.625	.625
Birmingham	1.50	1.125	1.375	1.125	1.00	.40	.40
Boston	1.50	1.375	1.625	1.375/1.625	1.625	.60/.85	.60/.85
Chicago	1.70	1.625	1.70	1.70	1.70	1.025	1.025
Cincinnati	1.625	1.45	1.55	1.375/1.525	1.625	.75	.75
Cleveland	1.625	1.375	1.50	1.50/1.75	1.50	.90	.90
Dallas	1.50	1.00	1.25	1.00	1.50	.40/.50	.40/.50
Denver	1.65*b*	1.43*b*	1.43*b*	1.43*b*	1.50*b*	.718*b*	.718*b*
Detroit	1.50	1.25	1.625	1.50	1.55	.60/.75	.60/.775
Kansas City	1.625	1.375	1.50	1.50	1.575	.85	.50
Los Angeles	1.25	1.125	1.375	1.375	1.50	.625	.625
Minneapolis	1.375	1.25*d*	1.50	1.40	1.50*e*	.85	.85
New Orleans	1.50	1.25	1.375	1.375	1.40	.40	.50
New York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*c*	1.031	.875/.95
Philadelphia	1.65*b*	1.40	1.65	1.50	1.75	.70	.70
Pittsburgh	1.75	1.50	1.50	1.25	1.75	.80	.70
St. Louis	1.50	1.50	1.75	1.50/2.00	1.75	.45/.875	.875
San Francisco	1.75*c*	1.25	1.60	1.50	1.60*c*	.813	.813
Seattle	1.60	1.25	1.50	1.50	1.60	.90	.90
Montreal	.80	.70	.75	.65	.80	.45	.40



b 7 hr. day. *c* 6 hr. day *d* 35 hr. wk. *e* 30 hr. wk.

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.431
ENR Common Average: $0.711

Roof Coatings

Insulated Roof Decks

Built-Up Roofs

Industrial Flooring

Air-Conditioning Equipment Housings

All-Asbestos Prefabricated Duct

Expansion Joints

Rock Wool Insulation

Corrugated Asbestos-Cement Roofing & Siding

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85% Magnesia Pipe Covering

Waterproofing

defend YOUR BUILDINGS AGAINST FIRE AND WEATHER

Cut Maintenance to the Bone with Carey ASBESTOS AND ASPHALT INDUSTRIAL PRODUCTS

Clear the decks for the main job—PRODUCTION. You can't afford at this time to be hampered by costly upkeep and inefficiency, either in buildings or equipment.

When you buy materials, buy on the basis of known performance, minimum yearly cost and maintenance. You get these definite results when you improve with CAREY materials.

CAREY Industrial Products cut costs from foundation to roof. They offer permanent protection against fire and weather . . . reduce heat losses . . . save fuel . . . prevent dampness . . . improve air conditioning . . . minimize maintenance.

CAREY materials are the development of over sixty years of manufacturing experience backed by extensive modern research and proving in the service of industry. Their use is insurance against costly experimentation. Write today for new book—"Proved Protection Against Wasted Profits"—Address Dept. 30.

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Construction Wage Rates and Trends

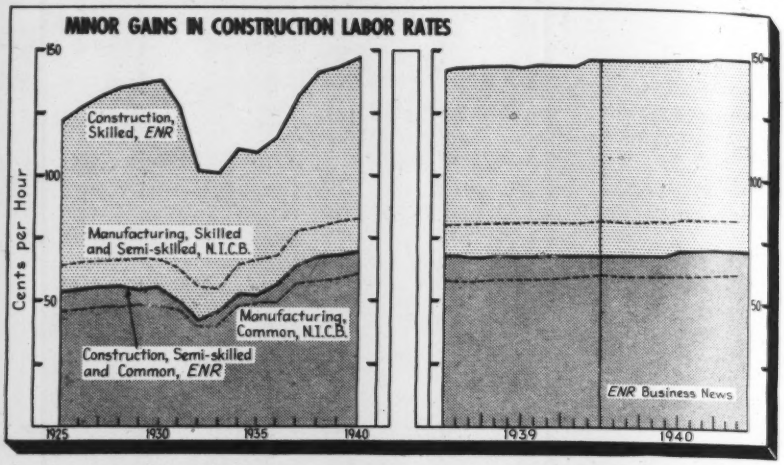
CONSTRUCTION WAGE averages in the common labor field opened 1940 at 68.5c. per hour. This 20-city average rate was unchanged until May when it climbed to 69c. The June average rate rose to 70.3c.; the July and August rates were 70.7c. In September the wage increased to 71.1c., a level which was maintained throughout the balance of the year.

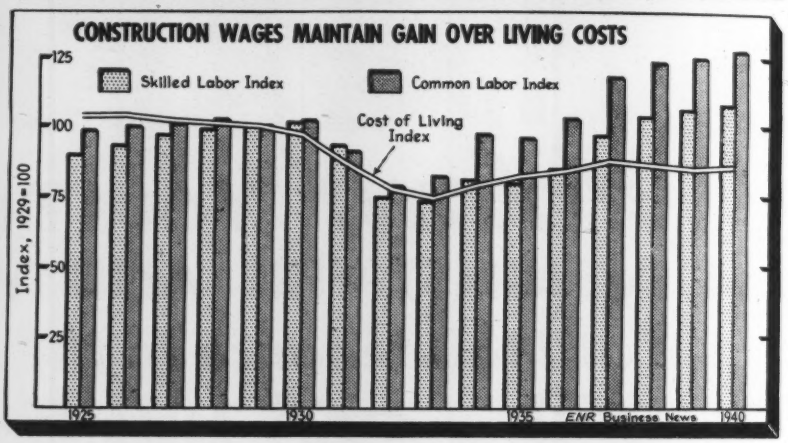
The result was a new record average hourly rate of 69.9c. per hour for 1940, an increase of 2.3 percent over 1939.

The skilled construction average rate for 20 cities followed a more even pattern than common labor. The skilled wage average began the year at $1.465 per hour, the rate which held to May. Minor increases were reported in May, June, July and September, and the rate finally wound up at $1.481 for December.

The 1940 average for skilled labor, $1.473, a new all-time high, was 2.1 percent above the preceding year.

Real income, that is, actual wages in relation to living costs continued to improve slightly for construction workers. The 1940 index of wage rates for the construction industry based on 1929 as 100 stood at 128 for common labor and 108.3 for skilled labor.





Construction Wages—Rates per Hour

20-CITIES AVERAGE REPORTED BY ENGINEERING NEWS-RECORD

CONSTRUCTION WAGES	Skilled Aver.†	Common
1910	$0.525	$0.179
1911	.534	.179
1912	.542	.182
1913	.555	.19
1914	.565	.177
1915	.57	.182
1916	.58	.192
1917	.61	.281
1918	.68	.38
1919	.78	.466
1920	1.05	.579
1921	1.06	.54
1922	1.01	.442
1923	1.10	.518
1924	1.19	.555

Notes:

†*ENR* Skilled Average represents rates for bricklayers, carpenters, iron workers.

(1) Skilled and Semi-skilled.

(2) Unskilled.

Both represent earnings per hour as reported by N. I. C. B.

* Checked monthly. Reported in first issue of *ENR* each month.

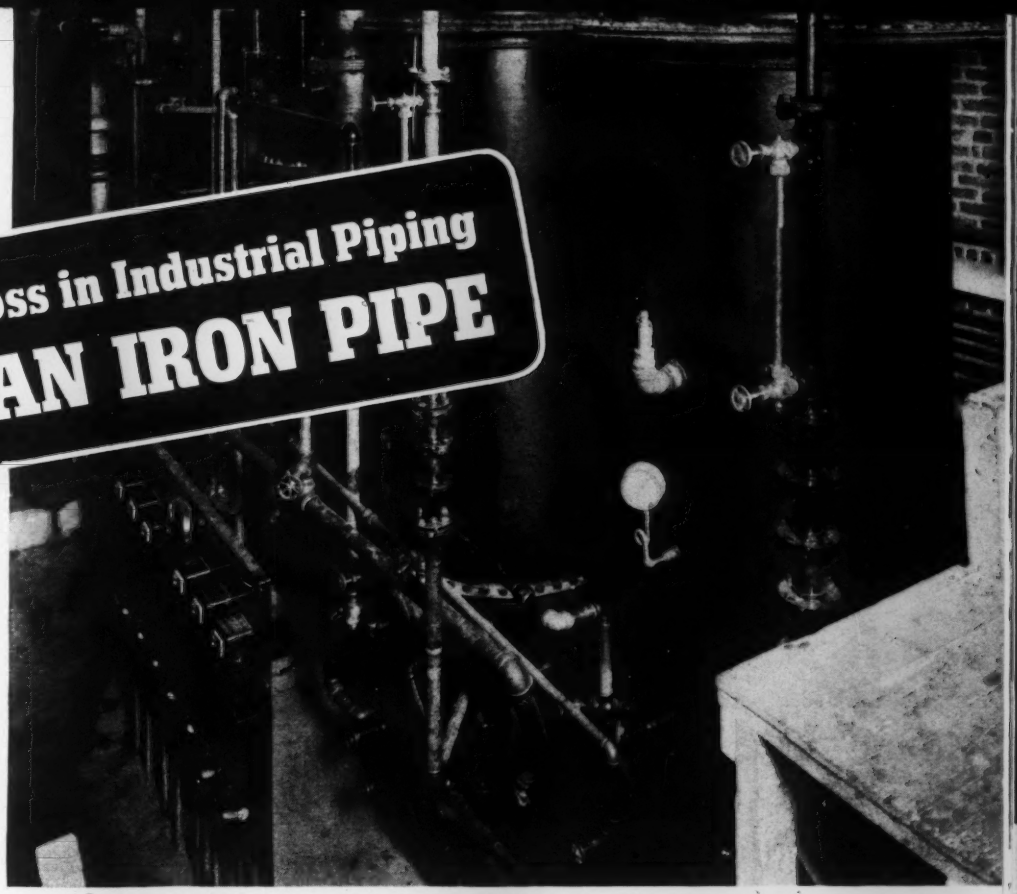
SKILLED LABOR †*

	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941
J	$1.21	$1.24	$1.28	$1.34	$1.35	$1.37	$1.37	$1.15	$0.989	$1.054	$1.108	$1.119	$1.22	$1.39	$1.43	$1.47	$1.47
F	1.21	1.24	1.32	1.34	1.35	1.38	1.37	1.11	.996	1.062	1.104	1.119	1.24	1.39	1.43	1.47	1.47
M	1.21	1.24	1.32	1.34	1.35	1.38	1.36	1.11	.991	1.069	1.092	1.132	1.25	1.40	1.43	1.47	1.47
A	1.22	1.25	1.30	1.35	1.35	1.38	1.36	.95	.997	1.084	1.093	1.134	1.26	1.40	1.44	1.47	1.48
M	1.22	1.26	1.31	1.36	1.35	1.38	1.36	.96	.998	1.101	1.081	1.138	1.30	1.40	1.44	1.47	....
J	1.23	1.27	1.33	1.35	1.36	1.38	1.32	.99	.994	1.101	1.074	1.138	1.33	1.41	1.44	1.47	....
J	1.22	1.27	1.33	1.35	1.36	1.38	1.23	1.00	.985	1.104	1.077	1.150	1.35	1.43	1.44	1.48	....
A	1.23	1.28	1.34	1.35	1.37	1.39	1.19	.98	.986	1.110	1.088	1.159	1.37	1.43	1.44	1.48	....
S	1.23	1.28	1.34	1.35	1.37	1.39	1.19	.99	1.016	1.119	1.088	1.159	1.37	1.43	1.44	1.48	....
O	1.23	1.29	1.33	1.35	1.37	1.39	1.17	.98	1.029	1.120	1.104	1.176	1.38	1.43	1.44	1.48	....
N	1.23	1.29	1.34	1.35	1.37	1.39	1.16	.97	1.037	1.120	1.101	1.178	1.38	1.43	1.46	1.48	....
D	1.24	1.29	1.33	1.35	1.37	1.39	1.15	.98	1.062	1.120	1.101	1.180	1.39	1.43	1.46	1.48	....
Aver.	**1.22**	**1.27**	**1.32**	**1.35**	**1.36**	**1.38**	**1.27**	**1.02**	**1.006**	**1.097**	**1.093**	**1.149**	**1.32**	**1.41**	**1.44**	**1.47**	....
Mfg. (1)	.644	.651	.656	.659	.668	.662	.634	.559	.55	.642	.662	.685	.78	.80	.81	.83	....

COMMON LABOR *

	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941
J	$0.55½	$0.54	$0.55½	$0.55	$0.559	$0.5628	$0.5384	$0.4524	$0.4271	$0.5158	$0.5376	$0.547	$0.603	$0.680	$0.682	$0.685	$0.711
F	.54	.54	.55½	.54½	.564	.5628	.5428	.4521	.4285	.5268	.5241	.547	.603	.675	.680	685	713
M	.54½	.54½	.56	.54½	.5509	.5610	.5371	.4358	.4272	.5268	.5243	.547	.612	.675	.680	685	716
A	.54½	.54½	.56	.55	.529	.5646	.5359	.4122	.4343	.5343	.5255	.552	.612	.677	.683	685	725
M	.54	.55	.55½	.55	.5315	.5628	.5394	.4105	.4442	.5343	.5233	.558	.627	.673	.682	690	....
J	.53	.55	.55½	.55½	.534	.5628	.5394	.4121	.4393	.5343	.5269	.564	.644	.677	.684	703	....
J	.53	.55½	.55½	.55½	.5296	.5615	.4721	.4114	.4430	.5300	.5289	.563	.662	.677	.684	707	....
A	.53	.55½	.55½	.5607	.5353	.5615	.4634	.4220	.4430	.5300	.5285	.569	.668	.677	.685	707	....
S	.53	.55½	.55½	.5607	.5496	.5609	.4665	.4308	.4524	.5349	.5285	.569	.673	.677	.685	711	....
O	.54	.55	.54½	.5628	.5496	.5596	.4584	.4308	.5057	.5363	.5285	.583	.676	.682	.685	711	....
N	.54	.55½	.54½	.5653	.5603	.5587	.4559	.4260	.5102	.5388	.5275	.583	.678	.682	.685	711	....
D	.54	.55½	.55	.5628	.5653	.5503	.4534	.4273	.5202	.5413	.5275	.586	.678	.682	.685	711	....
Aver.	**.538**	**.548**	**.554**	**.5558**	**.5465**	**.5607**	**.5002**	**.4269**	**.4562**	**.5319**	**.5276**	**.564**	**.645**	**.678**	**.683**	**699**	....
Mfg. (2)	.455	.461	.472	.474	.486	.478	.461	.401	.401	.478	.494	.498	.568	.584	.594	.61	....

Cut Corrosion Loss in Industrial Piping with TONCAN IRON PIPE



Toncan Iron Pipe, plates and welding rod were used throughout in the construction of high pressure evaporator.

IN THIS EMERGENCY

Paraphrasing an old operatic lyric—"A steelman's lot is not a happy one." When business is at low ebb, the struggle is to get enough tonnage to produce steel economically. When the tide of business swings to the other extreme, the big job we all have is to satisfy the customer who is unable to get all the steel he needs.

Believe me when I say that this is one time when the wheel that squeaks the loudest is not getting the grease. We are doing everything humanly possible to be helpful in this emergency and to be fair in the apportioning of our output—and to assist you further we are constantly setting new records in all our plants in our production of *steel—first line of national defense.*

R. J. Wysor
PRESIDENT

Somewhere in every industrial piping hook-up there is a place where the superior corrosion-resistance of Toncan* Iron Pipe makes it a good investment. It might be in a feed water line, in a boiler blow-off line, in evaporator or cooling tower or steam return line. Often this alloy iron pipe is used first in a plant where the wrench is most frequently applied. Then its use becomes more general because, having proved its extra resistance to corrosion where less durable materials need frequent and often costly replacement, it is only reasonable to expect it to show even longer life in less troublesome locations.

Nine advantages of Toncan Iron Pipe for industrial uses are listed in Booklet 333-R. Write for your copy now.

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Reg. U. S. Pat. Off.

REPUBLIC TONCAN IRON

An alloy of refined open-hearth iron, copper and molybdenum—*that grows old slowly*

Wage Rates per Hour
New York City

	Carpenters, 10 Hr. Day	Bricklayers, 8 Hr. Day	Masons' Laborers, 8 Hr. Day	Common Laborers, 10 Hr. Day	Structural Iron-Workers
1874	$0.23	$0.43	$0.18	$0.14	.....
1875	.22½	.37	.18	.14	.....
1876	.21	.31	.17	.14	.....
1877	.20	.31	.15	.12	.....
1878	.18	.31	.15	.11	.....
1879	.17	.31	.16	.11	.....
1880	.18	.34	.18	.12	.....
1881	.19	.46	.21	.13	.....
1882	.21	.50	.22	.15	.....
1883	.21	.50	.23	.13	.....
1884	.21	.50	.22	.13	.....
1885	.20	.50	.22	.13	.....
1886	.21	.50	.23	.13	.....
1887	.21	.50	.20	.14	.....
1888	.22	.50	.16	.12	.....
1889	.22	.50	.23	.13	.....
	8 Hr. Day			9 Hr. Day	
1890	.43	.47	.28	.14	.....
1891	.43	.47	.28	.14	.....
1892	.44	.50	.29	.14	.....
1893	.43	.50	.30	.14	.....
1894	.44	.50	.30	.14	.....
1895	.43	.50	.30	.14	.....
1896	.44	.50	.30	.14	.....
1897	.44	.50	.29	.14	.....
1898	.44	.50	.30	.14	.....
1899	.45	.55	.33	.14	.....
1900	.50	.56	.33	.14	.....
1901	.50	.59	.33	.19	.....
1902	.51	.65	.36	.17	.....
1903	.56	.65	.36	.16	.....
1904	.53	.65	.36	.19	.....
1905	.54	.70	.36	.20	.....
1906	.58	.70	.38	.21	.....
				—8 Hr. Day—	
1907	.62½	.70	.37½	.22	$0.60
1908	.62½	.70	.37½	.22	.60
1909	.62½	.70	.37½	.22	.60
1910	.62½	.70	.37½	.22	.62½
1911	.62½	.70	.37½	.22	.62½
1912	.62½	.70	.37½	.23	.62½
1913	.62½	.70	.37½	.22½	.62½
1914	.62½	.75	.37½	.22½	.62½
1915	.62½	.75	.37½	.25	.62½
1916	.62½	.75	.37½	.25	.66
1917	.69	.75	.42½	.30	.68
1918	.69	.81	.47	.40½	.80
1919	.75	.87½	.57½	.40½	.87½
1920	1.12½	1.25	.77½	.75	1.12½
1921	1.12½	1.25	.87½	.60	1.12½
1922	1.12½	1.25	.87½	.60	1.12½
1923	1.12½	1.50	.95	.61½	1.12½
1924	1.31½	1.50	1.00	.68¾	1.29
1925	1.31½	1.50	1.00	.65½	1.46¾
1926	1.45	1.64½	1.07	.81½	1.60
1927	1.50	1.75	1.12½	.90½	1.75
1928	1.50	1.75	1.12½	.90½	1.75
1929	1.55	1.84	1.15	.98½	1.81
1930	1.65	1.92½	1.03½	1.03½	1.92½
1931	1.45	1.71¼	1.02½	.65¼	1.92½
1932	1.33	1.47	1.00	.64½	1.67½
1933	1.37½	1.57½	.91	.72½	1.65
1934	1.40	1.53	.82½	.84¾	1.62
1935	1.40	1.50	.82½	.68	1.65
1936	1.40	1.50	.82½	.65	1.58
1937	1.60	1.73	.91	.76	1.79
	—7 Hr. Day—				
1938	1.75	1.88½	.99¾	.91¼	1.92½
1939	1.75	1.89½	1.03½	.91¼	1.92½
1940	1.81	1.96	1.03½	.91¼	1.96½
	1939 by Months				
Jan.	1.75	1.88½	1.03½	.87½/.95	1.92½
Feb.	1.75	1.88½	1.03½	.87½/.95	1.92½
Mar.	1.75	1.88½	1.03½	.87½/.95	1.92½
Apr.	1.75	1.88½	1.03½	.87½/.95	1.92½
May	1.75	1.88½	1.03½	.87½/.95	1.92½
June	1.75	1.88½	1.03½	.87½/.95	1.92½
July	1.75	1.90	1.03½	.87½/.95	1.92½
Aug.	1.75	1.90	1.03½	.87½/.95	1.92½
Sept.	1.75	1.90	1.03½	.87½/.95	1.92½
Oct.	1.75	1.90	1.03½	.87½/.95	1.92½
Nov.	1.75	1.90	1.03½	.87½/.95	1.92½
Dec.	1.75	1.90	1.03½	.87½/.95	1.92½
	1940 by months				
Jan.	1.75	1.90	1.03½	.87½/.95	1.92½
Feb.	1.75	1.90	1.03½	.87½/.95	1.92½
Mar.	1.75	1.90	1.03½	.87½/.95	1.92½
Apr.	1.75	1.90	1.03½	.87½/.95	1.92½
May	1.75	1.90	1.03½	.87½/.95	1.92½
June	1.85	2.00	1.03½	.87½/.95	1.92½
July	1.85	2.00	1.03½	.87½/.95	2.00
Aug.	1.85	2.00	1.03½	.87½/.95	2.00
Sept.	1.85	2.00	1.03½	.87½/.95	2.00
Oct.	1.85	2.00	1.03½	.87½/.95	2.00
Nov.	1.85	2.00	1.03½	.87½/.95	2.00
Dec.	1.85	2.00	1.03½	.87½/.95	2.00
	1941 by months				
Jan.	1.85	2.00	1.03½	.87½/.95	2.00
Feb.	1.85	2.00	1.03½	.87½/.95	2.00
Mar.	1.85	2.00	1.03½	.87½/.95	2.00
Apr.	1.85	2.00	1.03½	.87½/.95	2.00

Index of Union Hourly Wage Rates in Building Trades
(1929 = 100)

Industrial Relations Division
U. S. Department of Labor, Bureau of Labor Statistics

Year	All Building Trades	Journeyman	Helpers & Laborers	Bricklayers	Carpenters	Cement Finishers	Electricians (Inside Wiring)	Engineers (Portable & Hoisting)	Glaziers	Lathers	Painters	Plasterers	Plumbers & Gas Fitters	Sheet-Metal Workers	Steam & Sprinkler Fitters	Stonemasons	Structural Ironworkers	Building Laborers	Hod Carriers
1907	31.5	31.7	30.7	37.9	32.0	38.5	31.3	.....	.....	.....	27.5	39.9	37.8	33.8	33.8	34.7	31.8	35.0	33.1
1908	33.5	33.8	32.1	38.9	34.0	38.4	34.2	.....	.....	.....	30.5	39.8	38.2	34.5	34.2	35.2	34.7	35.2	33.2
1909	35.1	35.5	33.2	39.7	35.9	39.6	35.3	.....	.....	.....	32.6	40.1	38.8	34.7	38.9	35.3	37.2	35.3	33.3
1910	36.5	37.0	34.3	40.4	37.6	40.0	36.3	.....	.....	.....	34.6	40.5	39.1	35.7	36.1	35.6	39.5	36.7	33.8
1911	37.1	37.6	34.5	40.4	38.1	41.5	36.7	.....	.....	.....	35.3	40.8	41.4	36.8	37.3	36.0	40.5	36.8	34.1
1912	37.9	38.5	34.8	41.0	38.9	41.5	37.1	41.8	.....	39.4	35.7	41.6	41.6	37.6	37.9	36.4	41.2	37.2	34.3
1913	38.8	39.4	35.8	41.7	39.5	42.5	37.9	43.0	.....	40.3	37.3	42.0	43.0	39.3	39.3	37.6	42.5	38.8	34.8
1914	39.6	40.3	36.2	42.8	40.1	42.9	39.1	43.6	.....	41.0	38.5	42.2	43.6	40.7	40.0	38.7	43.3	39.2	35.2
1915	39.9	40.6	36.5	42.9	40.6	43.3	39.9	43.6	.....	41.5	38.7	42.4	43.9	41.3	40.9	39.1	43.3	39.4	35.4
1916	41.2	42.0	37.7	43.3	41.8	43.7	40.7	44.1	.....	42.7	42.3	43.9	44.3	42.0	41.7	39.7	44.0	41.2	36.5
1917	43.8	44.3	41.4	44.8	45.5	46.2	43.3	46.5	.....	44.4	43.6	45.2	45.8	43.8	43.3	41.2	46.6	45.5	40.7
1918	48.6	49.0	48.0	48.1	50.5	51.0	48.2	53.2	45.9	47.9	48.1	47.6	50.6	51.3	47.3	45.2	53.4	53.4	47.5
1919	55.7	56.0	55.5	53.4	58.2	57.2	55.2	58.3	49.1	53.3	56.3	54.9	57.2	56.6	53.2	50.7	60.1	60.5	55.6
1920	75.2	74.9	80.5	72.8	77.8	77.7	72.8	75.5	71.0	76.0	76.7	71.7	74.0	75.9	70.2	70.7	76.2	87.7	80.8
1921	76.6	76.3	81.3	72.3	78.4	80.3	75.4	76.7	72.2	77.2	78.9	75.6	77.4	78.7	71.1	72.4	77.6	88.2	81.2
1922	71.8	71.9	74.0	70.4	72.7	74.5	71.1	72.2	72.4	72.5	73.8	72.7	71.9	73.0	69.5	67.4	70.5	82.8	67.3
1923	79.4	79.2	78.5	79.7	81.0	81.5	73.8	79.8	76.7	80.1	81.0	81.0	79.4	78.6	72.9	79.7	75.1	84.4	73.5
1924	85.7	85.6	84.9	84.3	86.7	90.1	82.4	84.8	80.9	86.4	85.3	90.6	86.6	86.3	83.6	84.5	85.0	93.9	76.8
1925	89.0	88.8	87.7	89.2	88.5	90.6	86.7	88.5	90.0	94.2	90.0	92.1	88.4	89.2	88.0	86.1	85.9	89.7	85.8
1926	94.8	94.7	95.6	94.7	95.0	96.7	91.3	93.4	91.2	96.6	95.4	98.9	95.2	95.3	95.3	94.9	92.4	98.7	93.5
1927	98.1	97.9	97.3	97.0	98.1	101.0	95.1	96.4	97.4	100.5	98.6	101.0	97.2	98.2	98.0	96.1	99.0	99.1	98.7
1928	98.7	98.7	98.3	97.8	98.4	100.0	96.0	100.4	98.5	100.8	100.2	101.2	99.2	96.3	99.4	97.3	99.2	99.5	98.8
1929	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1930	104.2	104.1	105.1	102.4	104.0	106.6	101.8	107.7	104.6	104.3	105.6	105.0	103.9	104.6	104.9	101.5	105.5	105.5	102.8
1931	104.5	104.5	104.5	102.2	104.2	107.0	103.2	107.7	105.3	103.7	106.1	104.7	105.1	106.2	105.5	102.0	106.5	103.9	103.5
1932	89.3	89.3	89.2	87.5	85.4	93.4	98.5	100.7	88.2	93.1	89.6	87.1	91.4	92.1	90.9	90.5	92.3	89.4	85.8
1933	86.8	86.9	85.2	85.2	85.2	91.2	89.9	99.6	88.0	89.7	87.8	83.7	90.6	89.4	88.2	84.5	91.3	84.2	84.7
1934	87.4	87.4	87.7	84.5	86.7	92.1	90.1	101.4	93.2	92.1	86.4	84.6	91.4	89.7	89.2	84.4	92.5	87.3	90.3
1935	88.4	88.4	88.2	84.2	87.8	92.6	94.4	103.1	94.1	93.1	86.7	85.6	92.8	90.4	90.7	84.2	93.2	88.6	87.4
1936	91.6	91.3	93.4	84.7	92.3	95.0	96.9	104.2	95.5	95.5	91.1	86.1	95.2	92.2	93.7	85.2	95.6	96.2	92.1
1937	98.0	97.6	101.5	90.6	98.3	101.9	101.1	112.6	104.6	101.8	97.7	94.9	100.4	98.9	98.8	94.1	104.4	105.3	99.1
1938	106.7	106.1	111.7	100.1	107.1	111.3	111.4	116.0	112.2	112.7	104.2	106.1	112.5	108.8	111.4	102.1	112.7	112.9	109.1
1939	107.4	106.8	112.6	100.6	107.3	111.7	112.0	117.4	113.0	116.4	105.0	107.0	113.5	110.4	112.2	102.4	114.0	113.6	109.4
1940	109.1	108.3	114.8	102.8	110.0	112.7	113.9	118.4	114.3	117.2	105.2	107.5	115.3	112.4	112.5	101.9	114.4	115.4	113.6

Index of Weekly Hours in Union Building Trades
(1929 = 100)

Industrial Relations Division
U. S. Department of Labor, Bureau of Labor Statistics

Year	All Building Trades	Journeyman	Helpers & Laborers	Bricklayers	Carpenters	Cement Finishers	Electricians (Inside Wiring)	Engineers (Portable & Hoisting)	Glaziers	Lathers	Painters	Plasterers	Plumbers & Gas Fitters	Sheet-Metal Workers	Steam & Sprinkler Fitters	Stonemasons	Structural Ironworkers	Building Laborers	Hod Carriers
1907	110.0	109.3	113.1	112.0	107.2	109.1	110.3	.....	.....	.....	114.1	108.8	104.7	105.4	105.9	106.8	108.1	108.5	110.5
1908	108.3	107.7	110.8	109.6	105.6	108.1	109.5	.....	.....	.....	112.3	108.3	104.8	105.3	105.9	106.8	105.9	108.5	110.5
1909	106.8	106.4	108.5	107.3	104.4	108.9	108.8	.....	.....	.....	110.7	108.3	104.8	105.3	105.6	106.8	104.5	108.1	110.1
1910	105.5	105.2	106.6	105.3	103.1	108.7	108.2	.....	.....	.....	109.3	108.2	104.6	105.3	105.0	105.2	103.4	105.5	109.2
1911	105.1	104.8	106.4	104.9	102.6	107.7	108.0	.....	.....	.....	108.6	108.8	104.3	105.0	104.9	104.5	103.2	105.5	108.6
1912	104.8	104.5	106.1	104.9	102.5	107.7	107.6	105.6	.....	104.0	108.5	107.5	103.5	103.7	104.2	104.5	102.1	105.5	107.8
1913	104.6	104.2	106.1	104.7	102.4	106.5	107.2	104.1	.....	104.0	107.9	107.5	103.5	103.5	103.8	104.4	101.7	105.5	107.8
1914	104.2	103.9	105.5	104.2	102.0	105.8	106.8	104.0	.....	104.0	107.6	107.4	103.1	103.4	102.5	104.4	101.5	105.2	106.4
1915	104.1	103.8	105.4	104.1	102.0	105.8	106.2	103.5	.....	103.5	107.6	106.9	103.1	103.2	102.5	104.3	101.5	105.2	106.4
1916	103.7	103.4	105.1	103.9	102.0	104.2	105.3	103.1	.....	103.5	106.9	105.8	102.6	102.8	102.2	104.1	101.2	104.6	106.4
1917	103.5	103.2	104.7	103.6	102.0	103.0	104.9	102.4	.....	103.0	106.8	105.7	102.5	102.7	102.1	104.0	101.0	103.5	106.3
1918	102.9	102.6	104.3	103.6	100.9	102.5	104.2	100.8	101.6	103.0	106.3	105.4	101.6	101.6	101.1	104.0	100.7	103.0	106.3
1919	102.4	102.2	103.3	103.4	100.3	101.7	103.3	100.3	101.6	102.7	106.1	105.4	101.3	101.2	101.0	103.4	100.5	101.1	105.9
1920	101.9	101.7	102.7	103.3	100.4	101.2	103.0	99.8	101.2	102.1	103.0	105.2	101.3	100.8	100.9	103.4	100.5	100.0	105.7
1921	101.8	101.6	102.7	103.3	100.3	101.2	103.0	99.4	101.6	101.9	103.1	104.9	101.1	100.8	100.8	103.5	100.5	100.0	105.7
1922	101.8	101.7	102.4	103.3	100.4	101.1	103.0	99.1	101.7	102.0	103.9	105.0	101.1	100.7	100.8	103.4	100.5	99.3	105.9
1923	101.9	101.8	102.6	103.3	100.7	101.1	103.0	98.7	101.2	102.3	103.6	105.5	101.1	100.7	100.8	103.4	100.5	100.0	105.9
1924	101.9	101.8	102.6	103.2	100.6	101.1	102.9	98.7	101.2	102.1	103.5	105.6	101.1	100.7	100.8	103.1	100.5	99.7	105.8
1925	101.9	101.8	102.4	103.1	100.6	100.8	102.9	99.0	100.8	101.8	103.8	105.3	101.1	100.7	100.8	103.1	100.2	99.8	105.7
1926	101.7	101.6	102.2	103.2	100.6	100.8	102.9	99.2	101.2	101.5	103.4	102.2	101.1	100.7	100.7	103.3	100.5	100.0	105.8
1927	101.5	101.4	102.2	102.7	100.6	100.5	102.9	100.8	101.5	101.0	103.0	101.8	100.9	100.4	100.5	103.1	100.5	100.2	105.8
1928	100.9	100.7	102.1	102.7	100.0	99.9	102.4	99.7	101.1	100.5	100.3	100.9	100.9	100.1	100.5	103.0	100.4	100.1	105.8
1929	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1930	97.2	97.1	97.8	97.6	96.9	96.1	97.6	95.1	96.8	94.3	98.9	97.7	95.4	96.3	95.5	96.6	96.9	98.1	99.3
1931	96.0	95.8	97.0	96.1	95.4	95.0	96.6	93.7	95.1	93.8	98.0	97.0	94.1	94.7	94.5	94.9	95.8	97.0	98.9
1932	94.3	94.1	94.8	93.9	93.0	93.9	94.3	92.6	92.9	93.3	97.9	95.2	93.7	93.3	93.6	94.5	93.4	93.6	96.6
1933	94.0	93.8	94.4	94.9	91.6	95.7	94.3	91.7	92.9	92.9	97.7	97.2	93.3	93.2	93.1	93.8	93.1	93.2	96.1
1934	90.5	90.3	91.4	93.3	90.8	92.2	88.7	89.7	88.1	87.5	85.6	93.1	92.4	91.9	92.5	93.4	91.8	89.1	94.3
1935	89.8	89.6	90.8	93.2	90.4	92.0	85.1	89.2	87.5	87.4	85.5	91.6	91.8	92.0	92.2	93.3	90.7	89.0	94.2
1936	89.8	89.6	91.0	93.2	90.5	91.6	85.4	89.7	87.8	86.5	85.9	90.1	90.6	91.9	92.4	93.3	90.6	89.5	94.0
1937	90.2	90.0	91.3	94.1	90.3	91.7	89.6	89.5	87.9	87.7	85.9	90.2	91.1	92.0	92.5	93.3	90.2	89.7	94.3
1938	88.7	88.4	89.9	91.0	88.6	88.9	89.1	89.3	86.3	86.1	86.0	86.5	86.5	90.1	87.6	90.2	89.2	89.3	93.2
1939	88.5	88.3	89.7	91.1	88.6	88.9	88.8	89.2	86.1	85.4	85.7	86.5	86.8	90.1	88.0	90.2	89.1	89.2	92.9
1940	88.4	88.3	89.2	90.8	88.6	89.1	88.8	89.1	86.1	85.2	86.1	86.3	85.9	90.1	88.0	90.1	89.1	88.7	92.8

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DIVISION OF THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA

THE BALDWIN GROUP

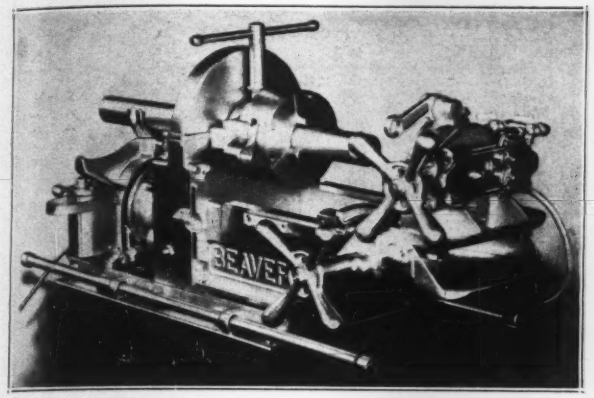
Building Trades Wage Rates Prevailing March 1, 1941

Compiled by Engineering News-Record

City and State	Carpenters	Bricklayers	Structural Ironworkers	Common Labor Buildings	Common Labor Hvy. Constr.	Stone Masons	Mason's Helpers	Plasterers	Mosaic and Terrazzo	Tile Layers	Cement Finishers	Lathers	Electric Workers (inside)	Painters	Glaziers	Plumbers	Steamfitters	Roofers	Waterproofers	Sheet Metal Workers	Welders	Hoisting Engr. 1-Drum	Hoisting Engr. 2-Drum	Tractor Operator (Over 30-hp.)	Power Shovel Operator	Truck Drivers (Over 11 tons)
Albany, N. Y.[1]	$1.18	$1.38	$1.38	$0.70	$0.70	$1.38	$ .70	$1.38	$1.25	$1.25	$1.38	$1.65	$1.25	$1.13	$1.13	$1.38	$1.38	$1.20	$1.20	$1.20	$1.38	$1.55	$1.75	$1.30	$1.80	$0.67
Anderson, Ind.	1.15	1.50	1.80	.70	.90	1.50	.90	1.50	1.25	1.50	1.25	1.50	1.25	1.25	1.38	1.18	1.38	1.35	1.25	1.50	1.60	....	....	1.45	1.45	.75
Austin, Tex.	1.13	1.50	1.50	.40	.40	1.50	.65	1.50	1.50	1.50	1.25	1.50	1.50	1.00	1.00	1.25	1.25	1.00	1.00	1.00	1.50	1.00	1.25	.70	1.25	.70
Baltimore, Md.	1.25	1.50	1.65	.63	.63	1.50	.88	1.50	1.25	1.38	1.38	1.50	1.50	1.13	1.25	1.38	1.38	1.25	1.38	1.38	1.50	1.50	1.80	1.00	1.80	.70
Birmingham, Ala.	1.13	1.50	1.50	.40	.40	1.25	.50	1.25	1.25	1.25	1.25	1.00	1.25	1.13	1.13	1.25	1.25	1.00	1.00	1.25	.....	1.00	1.25	.....	1.50	.60
Bismarck, N. D.	1.00	1.40	1.20	.50	.50	1.14	.80	1.10	1.10	.80	1.25	1.40	1.25	1.00	1.00	1.30	1.30	1.00	.....	1.30	1.00	1.20	1.25	.65	1.30	.85
Boise, Idaho	1.13	1.38	1.25	.63	.63	....	....	1.25	.....	.....	1.00	1.13	1.25	1.13	1.10	1.25	1.25	1.00	.....	1.00	.....	1.38	1.50	1.25	1.50	.75
Boston, Mass.	[11]1.38	[11]1.50	1.50	.85	.85	1.50	.85	1.67	1.50	1.50	1.45	1.67	1.50	[12]1.25	1.38	1.50	1.50	1.38	1.50	1.50	†	[21]1.38	[21]1.38	[21]1.38	[21]1.63	[3]1.80
Charleston, S. C.	1.00	1.25	1.25	.40	.40	1.25	.50	[4]1.00	1.25	1.25	1.25	1.25	1.25	1.00	1.00	[5]1.25	1.50	1.00	1.25	1.00	1.50	1.25	1.50	1.00	1.50	.75
Charleston, W Va.[6]	1.13	1.50	1.50	.55	.55	1.50	.68	1.38	1.25	1.25	1.10	1.25	1.38	1.00	1.00	1.25	1.25	1.13	.....	1.25	1.50	1.38	1.38	1.38	1.38	.65
Chattanooga, Tenn.	1.25	1.50	1.25	.45	.35	1.50	.60	1.50	1.50	1.50	1.25	1.25	1.25	1.00	1.00	1.50	1.50	.85	1.00	1.00	†	1.00	1.25	1.00	1.25	.60
Cheyenne, Wyo.	1.13	1.13	1.25	.55	.55	1.25	.75	1.25	1.25	1.25	1.25	1.25	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.25	1.25	1.50	.75
Chicago, Ill.	1.63	1.70	1.70	1.03	1.03	1.70	...	1.70	1.63	1.63	1.63	1.70	1.70	1.67	1.94	1.70	1.70	1.75	1.75	1.70	1.70	1.70	1.70	....	2.00	....
Cincinnati, Ohio.	1.45	1.63	1.55	.75	.75	1.63	.75	1.63	1.25	1.40	1.38	1.40	1.50	1.35	1.55	1.50	1.50	1.40	1.25	1.38	†	1.38	1.53	1.00	1.53	.80
Cleveland, Ohio.	1.50	1.75	1.75	1.00	1.00	1.75	1.00	1.63	1.50	1.50	1.50	1.63	1.63	1.40	1.50	1.63	1.63	1.55	1.55	1.50	1.75	1.50	1.50	1.30	1.75	.95
Columbia, S. C.	.88	1.25	1.25	.30	.30	1.25	.50	1.00	1.13	1.13	1.00	1.25	1.00	1.00	1.00	1.25	1.25	.75	.50	1.25	.90	.75	1.25	1.00	1.00	.50
Columbus, Ohio.	1.25	1.56	1.50	.60	.65	1.45	.80	1.55	1.25	1.25	1.25	1.55	[7]1.25	1.15	1.13	1.38	1.38	1.20	1.20	1.25	1.50	1.30	1.30	1.15	1.50	.75
Conway, Ark.	.60	1.50	....	.35	.25	1.50	.40	1.25	.....	.....	1.00	.60	.88	.60	.....	1.00	1.00	.60	.60	1.00	.....	.....	.....	.....	.....	.....
Dallas, Tex.	1.13	1.50	1.25	.50	.50	1.50	.75	1.50	1.50	1.25	1.25	1.13	1.50	1.00	1.00	1.50	1.50	1.00	1.00	1.50	1.50	1.25	1.38	1.38	1.38	.50
Dayton, Ohio.	1.38	1.65	1.50	.60	.60	1.65	1.00	1.50	.....	1.50	1.25	1.50	1.65	1.25	1.38	1.40	1.40	1.20	.....	1.38	.....	.....	1.50	1.25	1.50	.75
Denver, Colo.	1.43	1.65	1.43	.71	.71	1.65	1.00	1.50	1.43	1.50	1.43	1.50	1.50	1.43	1.20	1.50	1.50	1.43	1.40	1.43	.....	1.43	1.43	1.43	1.50	1.00
Detroit, Mich.	1.25	1.50	[8]1.63	.80	.80	1.50	.80	1.55	1.44	1.50	1.25	1.55	1.65	1.25	1.25	[8]1.50	[8]1.50	1.25	1.25	1.38	1.63	1.63	1.63	.90	1.63	.90
Duluth, Minn.	1.13	1.25	1.50	.60	.60	1.25	.60	1.00	1.25	1.25	1.00	1.35	1.13	1.00	.85	1.25	1.25	1.00	1.00	1.10	1.50	1.40	1.40	1.00	1.50	.85
East Lansing, Mich.	1.13	1.65	1.83	.65	.65	1.65	.80	1.50	1.50	1.50	1.25	1.50	1.85	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.50	1.50	1.50	1.50	1.50	.85
Fort Worth, Tex.	1.13	1.50	1.25	.40	.40	1.50	.75	1.50	.....	1.38	1.25	1.50	1.50	1.13	1.13	1.50	1.50	1.00	1.00	1.50	†	1.25	1.38	1.25	1.38	.55
Frankfort, Ky.	.90	1.38	1.50	.50	.50	1.38	.60	1.25	1.00	1.00	1.00	1.38	1.00	.90	1.00	1.25	1.25	1.00	.90	1.00	1.50	1.00	1.25	.60	1.25	.60
Galesburg, Ill.	1.13	1.38	1.38	.80	.80	1.38	.90	1.38	.....	1.38	1.25	1.25	1.38	1.00	1.15	1.25	1.25	1.00	1.00	1.10	.....	1.38	1.50	1.38	1.50	.85
Harrisburg, Pa.	1.00	1.38	1.50	.50	.50	1.38	.93	1.25	1.38	1.43	1.50	1.38	1.25	1.00	1.00	1.25	1.25	1.00	1.00	1.25	1.38	1.50	1.50	1.50	1.60	.70
Helena, Mont.	1.13	1.50	1.50	.75	.75	1.50	1.00	1.50	.....	.....	1.50	1.50	1.38	1.13	.....	1.38	1.38	1.25	.....	1.25	1.50	1.25	1.25	1.50	1.50	.70
Houston, Tex.	1.25	1.50	1.50	.30	.45	1.50	.63	1.50	1.38	1.38	1.25	1.50	1.50	1.13	1.13	1.50	1.50	1.50	1.00	1.50	†	.....	.....	1.25	1.50	[9]1.50
Indianapolis, Ind.	1.25	1.60	1.55	[10].70	[10].70	1.60	.....	1.58	1.15	1.50	1.25	1.45	1.50	1.25	1.25	1.50	1.50	[13]1.15	1.25	1.10	1.25	1.30	1.45	.....	1.45	1.10
Jackson, Miss.	1.25	1.50	2.00	.40	.45	1.50	.45	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.25	1.50	1.50	.88	.88	.88	1.50	1.00	1.00	.75	1.00	.40
Jacksonville, Fla.	1.13	1.25	1.25	.60	.60	1.25	.60	1.50	1.25	1.25	1.25	1.50	1.38	1.25	1.00	1.25	1.25	1.00	1.00	1.25	1.38	1.38	1.38	1.13	1.50	.60
Jamestown, N. Y.	1.20	1.50	1.50	.65	.65	1.50	.65	1.50	1.10	1.10	1.50	1.50	1.20	1.00	1.10	1.00	1.25	1.10	1.10	1.00	1.00	1.25	1.50	.75	.75	.65
Jefferson City, Mo.	1.00	1.50	1.75	.65	.88	1.50	.88	1.50	1.50	1.50	1.50	1.00	1.50	1.00	1.00	1.25	1.25	1.00	1.00	1.00	1.75	1.50	2.00	1.50	2.00	.90
Kansas City, Mo.	1.38	1.63	1.50	.85	.85	1.38	.90	1.38	1.25	1.25	1.38	1.50	1.50	1.38	1.50	1.50	1.50	1.25	1.38	1.50	1.38	1.38	1.50	1.00	1.50	.75
Lincoln, Nebr.	.88	1.38	1.00	.50	.50	1.38	.65	1.38	1.00	1.25	1.00	1.00	1.00	.70	.....	1.25	1.25	.80	.80	.85	.70	.70	.70	.60	1.50	.50
Lexington, Ky.	1.10	1.50	1.50	.60	.60	1.50	.80	1.25	1.50	1.50	1.25	1.25	1.25	1.10	1.10	[11]1.25	[11]1.25	.90	.90	.90	†	1.50	1.50	1.25	1.50	.75
Little Rock, Ark.	1.00	1.50	1.50	.40	.50	1.50	.65	1.50	1.50	1.50	1.25	1.50	1.00	1.00	1.00	1.00	1.00	.65	1.50	1.00	1.00	1.00	1.00	1.00	1.00	1.30
Los Angeles, Calif.	[14]1.10	1.25	1.38	.63	.63	1.25	.88	1.50	1.25	1.25	1.38	1.50	1.13	1.05	1.10	1.25	1.25	1.00	1.00	1.13	1.25	1.13	1.13	1.13	1.50	1.00
Louisville, Ky.	1.25	1.00	1.50	.60	.50	1.50	.75	.85	.....	1.25	.85	.85	1.31	1.00	.....	1.00	1.50	1.00	.....	1.25	.95	1.00	1.00	.85	1.00	.85
Madison, Wis.	1.10	1.38	1.38	.70	.70	1.38	.70	1.38	1.25	1.25	1.10	1.30	1.38	1.05	1.05	1.38	1.38	.90	.90	1.20	1.38	1.25	1.25	1.25	1.38	.65
Meridian, Miss.	1.25	1.25	2.00	.35	.45	1.25	.41	1.25	1.25	1.25	1.25	1.30	1.25	1.00	.85	1.25	1.30	*.75	....	.85	1.00	.65	1.00	.60	1.00	.40
Milwaukee, Wis.	1.20	1.45	1.38	.85	.85	1.45	.95	1.38	1.38	1.38	1.30	1.38	1.30	1.13	1.20	1.35	1.35	1.35	1.00	1.20	1.38	1.35	1.35	1.30	1.65	.85
Minneapolis, Minn.	1.25	1.38	1.50	.85	.85	1.38	.85	1.50	1.25	1.33	1.25	1.50	1.50	1.25	1.05	1.38	1.38	1.20	1.20	1.25	†	1.40	1.40	1.50	1.50	.75
Mobile, Ala.	1.13	1.50	1.38	.50	.65	1.50	.....	1.25	.....	1.50	1.25	1.25	1.25	1.00	1.00	1.50	1.50	1.25	1.25	1.00	.....	1.13	1.38	1.38	1.38	.70
Nashville, Tenn.	1.15	1.50	1.25	.40	.40	1.50	.65	1.38	1.50	1.50	1.25	1.25	1.25	1.00	1.00	1.50	1.38	.75	1.13	1.25	1.00	1.25	1.25	1.25	1.25	.65
Newark, N. J.	1.75	1.85	2.00	1.13	1.13	1.85	1.13	1.85	1.85	1.69	1.85	2.00	2.00	1.43	1.44	[12]1.50	[12]1.65	1.60	1.60	1.75	2.00	2.00	2.00	2.00	2.00	1.00
New Britain, Conn.	1.06	1.25	1.65	.88	.88	1.25	.88	1.25	1.25	1.25	1.25	1.38	1.25	1.13	1.13	1.13	1.13	1.13	1.25	1.13	.....	.....	.80	1.30	1.30	.70
New Orleans, La.	1.25	1.50	1.50	.55	.55	1.50	.75	1.38	1.50	1.50	1.25	1.50	1.45	1.00	1.00	1.38	1.38	1.00	1.00	1.13	1.27	1.13	1.38	1.13	1.38	.50
New York, N. Y.	1.85	2.00	2.00	1.03	[15].88	1.90	1.20	2.00	1.75	1.69	1.85	1.85	2.00	1.60	1.89	2.00	2.00	1.86	1.60	1.85	†	1.75	2.03	1.38	2.25	1.00
Oklahoma City, Okla.	1.00	1.25	1.25	.50	.45	1.50	1.00	1.50	1.50	1.50	1.50	1.25	1.38	1.00	1.00	1.50	1.50	1.25	1.25	1.25	1.50	1.25	1.50	1.00	1.25	.75
Olympia, Wash.	1.50	1.75	1.55	1.00	1.00	1.75	1.25	1.75	1.75	1.75	1.38	1.50	1.50	1.33	1.25	1.55	1.55	1.25	1.25	1.25	1.20	1.50	1.50	1.50	1.85	1.20
Omaha, Nebr.	1.20	1.45	1.38	.55	.55	1.45	.55	1.38	1.25	1.25	1.25	1.31	1.50	1.00	1.10	1.38	1.38	1.10	.95	1.13	.90	1.25	1.38	1.25	1.38	.60
Orlando, Fla.	1.00	1.25	1.25	.35	.35	1.25	.40	1.25	1.00	1.25	1.25	.88	1.15	.90	.90	1.25	1.00	1.00	1.00	1.00	1.25	.75	1.00	.50	1.00	.40
Phoenix, Ariz.	1.25	1.50	1.38	.75	.75	1.25	.75	1.50	1.50	1.50	1.25	1.25	1.13	1.13	1.00	1.38	1.38	1.00	1.00	1.13	1.38	1.25	1.25	.75	1.50	.88
Pierre, S. D.	.85	1.00	1.00	.45	.55	1.00	.55	1.00	1.00	1.00	.75	.80	1.00	.80	.80	1.00	1.00	.75	1.00	1.00	1.00	1.00	1.00	.75	.75	.55
Pittsburgh, Pa.	1.50	1.75	1.50	.80	.70	1.63	1.13	1.75	1.50	1.50	1.50	1.75	1.65	1.50	1.40	1.70	1.70	1.50	1.50	1.50	1.50	1.56	1.63	1.38	1.63	.75
Portland, Me.	.80	1.25	1.25	.50	.50	1.25	.50	1.25	1.25	1.25	1.25	1.20	1.20	.75	.75	1.25	1.25	1.00	1.00	1.00	†	1.25	1.50	1.38	1.38	.69
Portland, Ore.	1.20	1.50	1.45	.83	.68	1.50	1.13	1.50	1.35	1.25	1.20	1.50	1.50	1.18	1.25	1.50	1.50	1.25	1.25	1.25	†	1.40	1.40	1.20	1.45	.90
Providence, R. I.	1.18	1.50	1.50	.60	.60	1.50	.70	1.50	1.50	1.50	1.15	1.50	1.25	1.00	1.00	1.35	1.38	1.25	1.25	1.25	†	1.50	1.75	1.50	1.75	.73
Raleigh, N. C.	.90	1.25	1.25	.30	.40	1.25	.45	1.10	1.25	1.20	1.25	1.25	.90	.90	.75	1.25	1.25	1.10	.40	1.10	1.50	.85	1.25	.45	1.50	.35
Reno, Nev.	1.25	1.75	1.60	.63	.63	....	1.18	1.75	.....	.....	.....	1.75	1.50	2.00	1.31	1.50	1.50	1.38	.....	1.25	.....	.....	.....	.....	.....	.75
Richmond, Va.	1.00	1.50	1.50	.40	.40	.....	.....	1.38	.....	.....	1.38	1.38	1.25	.80	.81	1.25	1.25	.....	.....	1.25	†	1.25	1.50	1.50	1.25	.50
St. Louis, Mo.	1.50	1.50	1.75	.88	.88	1.25	1.00	1.75	1.50	1.50	1.58	1.63	1.50	1.50	1.50	1.63	1.63	1.88	1.58	1.50	1.50	1.50	2.00	1.50	2.00	1.00
Salt Lake City, Utah.	1.13	1.38	1.38	.65	.65	1.38	.90	1.50	1.13	1.13	1.13	1.50	1.13	1.00	1.00	1.10	1.10	.90	.90	1.10	1.38	1.25	1.25	1.00	1.25	.90
San Antonio, Tex.	1.13	1.50	1.50	.50	.40	1.50	.50	1.50	1.25	1.25	1.50	1.50	1.25	1.25	1.00	1.50	1.50	1.25	1.00	1.25	†	1.13	1.38	1.13	1.38	.50
San Diego, Calif.	1.13	1.50	1.38	.75	.75	1.50	.88	1.50	1.25	1.25	1.25	1.50	1.38	1.13	1.10	1.38	1.38	1.00	1.00	1.25	1.38	1.75	1.75	1.25	1.75	1.00
San Francisco, Calif.	1.25	1.75	1.60	.85	.85	1.50	1.25	1.67	1.00	1.38	1.25	1.60	1.50	1.25	1.25	1.53	1.38	1.25	.....	1.25	.....	1.38	1.38	1.50	2.00	1.00
Santa Fe, N. M.	1.25	1.50	1.50	.40	.40	1.50	.85	1.50	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.50	1.25	1.25	1.00	1.25	1.50	1.00	1.00	1.25	1.25	.75
Seattle, Wash.	1.35	1.65	1.55	.95	1.00	1.65	1.20	1.65	1.40	1.40	1.35	1.55	1.55	1.35	1.30	1.55	1.55	1.35	.....	1.50	1.55	1.50	1.50	1.50	1.85	1.25
Springfield, Ill.	1.38	1.63	1.50	[1].85	[1].85	1.63	1.00	1.75	1.50	1.50	1.25	1.50	1.40	1.25	[11]1.25	1.50	1.50	1.30	1.30	1.40	.....	1.35	1.50	1.15	1.65	.80
Springfield, Mass.	1.25	1.63	1.50	1.00	1.00	1.63	1.00	1.63	1.63	1.63	1.63	1.50	1.38	1.13	1.13	1.38	1.38	1.38	1.38	1.38	†	1.50	1.50	1.50	1.50	.80
Tallahassee, Fla.	.75	1.38	1.25	.25	.40	1.50	.75	1.38	1.50	1.50	1.25	.60	1.25	.88	1.25	1.38	1.50	1.00	.75	.75	1.50	1.00	1.50	1.00	1.50	.75
Toledo, Ohio.	1.38	1.63	1.63	.75	.75	1.63	.....	1.65	1.25	1.50	1.63	1.65	1.65	1.30	1.13	1.50	1.50	1.25	1.63	1.25	1.63	1.38	1.38	1.38	1.63	.85
Topeka, Kan.	1.00	1.38	1.40	.45	.45	1.13	.45	1.00	1.00	1.25	1.25	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.85	1.50	1.50	.60	.85	.65	.85	.50
Trenton, N. J.	1.50	1.50	1.90	.80	.65	1.63	.80	1.63	.....	1.38	1.63	1.65	1.88	1.65	1.25	1.50	1.50	1.40	1.40	1.50	2.00	[13]1.75	[13]1.75	1.25	[13]1.75	.88
Tucson, Ariz.	1.15	1.50	1.38	.63	.63	1.50	.88	1.50	1.50	1.50	1.13	1.25	[14]1.13	1.00	1.00	[14]1.25	[14]1.25	1.00	1.00	1.13	1.38	1.25	1.50	1.50	1.50	1.00
Wilmington, Del.	1.25	1.50	1.65	.60	.60	1.50	.90	1.38	1.25	1.25	1.25	1.38	1.13	1.10	1.10	1.25	1.25	1.00	1.00	1.25	.85	1.50	1.50	.76	1.50	.76

† Rate same as trade in connection with which they work. * Per square yard. [1] Negotiating new agreements; increases expected in April, May or June. [2] Broken time rate $1.87½. [3] Broken time rate $1.87½. [4] $1.25 after May 1, 1941. [5] $1.50 after May 1, 1941. [6] Average increase of $1.00 per 8 hr. day in heavy construction trades expected April 1, 1941. [7] $1.37½ after June 1, 1941. [8] Increase of 12½c. after April. [9] In city 95c. [10] 75c. after April 1. [11] $1.25 after April 1. [12] $1.75 April 1. [13] On excavation; on steel rate is $2.25. [14] Up 12½c. after May 1. [15] 95c. after June 1. [21] $1.25 after May 12.

The A-B-C of Pipe and Bolt Machines



BEAVER MODEL-A

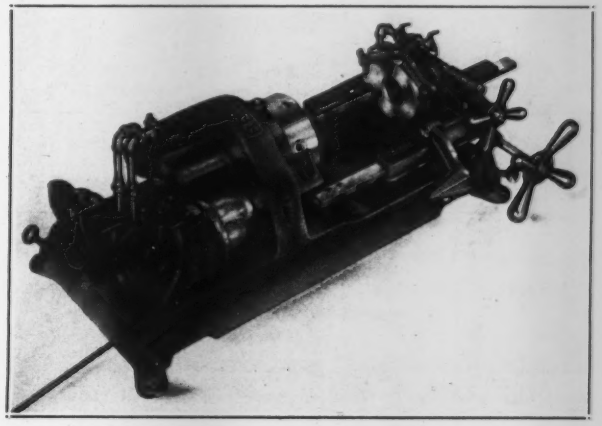
⅛ to 2-inch Pipe and Bolt Machine

A HIGH-SPEED heavy-duty deluxe pipe and bolt machine, complete in every detail and admitted leader in its field. Will cut, thread and ream 1/8 to 2-inch pipe and, with drive shaft and geared tools, will cut and thread 2-1/2 to 12-inch pipe. Threads bolts 1/4 to 2-inch; cuts off bolts (wheel cutter) up to 7/8-inch. New high speed model out performs all competition. Right-handed—like a lathe. More than 50% greater open working space. All controls in front. Wheel or knife cutoff. Standard geared chuck with automatic safety wrench ejector. Safety shear pin. Ring-type opening adjustable dieheads—no hinge. Die segments adjust simultaneously as a unit. Choice 110 or 220 volt universal reversible motor. Automatic gear-driven oil pump. Weight approximately 415 pounds.

BEAVER MODEL-B

⅛ to 2-inch Pipe and Bolt Machine

A HIGHLY efficient, compact, low-priced Portable Utility Machine embodying many advanced features heretofore available only on higher priced machines. Complete range 1/2 to 8-inch pipe; 1/4 to 1-1/2-inch bolts. Rack-and-pinion feed; 60% more power; one-piece cast steel-iron base and cap—no flimsy sheet metal housings; sockets for pipe legs to form inexpensive but sturdy stand; all-steel geared universal 1/8 to 2-inch chuck—with safety automatic chuck wrench ejector; hinged full-range reamer; sliding wheel or knife cutoff; ring-type opening adjustable dieheads—no hinge. Automatic gear-driven oil pump. Adequate motor ventilation. Choice of 110 or 220 volt universal reversible motor. Weight approximately 280 pounds.



BEAVER MODEL-C

⅛ to 8-inch Portable Power Unit

CONVERTS hand tools into electric power tools. It will cut, thread and ream 1/8 to 2-inch pipe. With driveshaft and geared tools 2-1/2 to 8-inch pipe may be cut and threaded. Bolts up to 1-1/2-inch size. Has ample power to allow for dull dies and low line voltage. Choice of 110 or 220 volt universal reversible motor. Now equipped with automatic chuck wrench ejector and safety latch—to protect machine and workman. Equipped with legs, vise and bender, the Beaver Model-C becomes a complete portable electric pipe shop. Model C-2 is designed to accommodate a 1/2 to 2-inch vise. Hundreds of users, in all parts of the world, say the Beaver Model-C is "the best investment we ever made."

Write for complete catalog of Beaver Pipe Tools (Hand and Power)—Cutters—Threaders — Reamers — Beveling and Grooving Tools, Pipe and Bolt Machines.

Yearly Average WAGES OF SIX BUILDING TRADES in Seven Cities

Bricklayers

	Boston	New York	Chicago	Birmingham	St. Louis	San Francisco	Seattle
1913	$0.65	$0.70	$0.75	$0.70	$0.70	$0.875	$0.75
1914	.65	.75	.75	.70	.75	.875	.75
1915	.65	.75	.75	.70	.75	.875	.75
1916	.65	.75	.75	.70	.75	.875	.75
1917	.70	.75	.75	.70	.75	.875	.81
1918	.80	.81	.75	.875	.85	1.00	1.00
1919	.80	.875	.875	.875	1.00	1.125	1.125
1920	1.00	1.25	1.25	1.00	1.25	1.25	1.25
1921	1.00	1.25	1.25	1.00	1.25	1.25	1.125
1922	1.00	1.25	1.10	1.00	1.25	1.25	1.125
1923	1.25	1.50	1.10	1.125	1.50	1.375	1.25
1924	1.25	1.50	1.35	1.125	1.75	1.25	1.25
1925	1.25	1.50	1.50	1.25	1.75	1.25	1.35
1926	1.35	1.645	1.56	1.25	1.75	1.25	1.375
1927	1.40	1.75	1.625	1.25	1.75	1.375	1.375
1928	1.42	1.75	1.625	1.45	1.75	1.375	1.4275
1929	1.50	1.84	1.65	1.50	1.75	1.375	1.50
1930	1.50	1.925	1.70	1.50	1.75	1.375	1.50
1931	1.50	1.7125	1.70	.8125	1.75	1.375	1.1875
1932	1.105	1.47	1.40	.825	1.50	1.175	.975
1933	1.10	1.575	1.406	.812	1.50	1.125	1.01
1934	1.12	1.53	1.50	1.00	1.50	1.50	1.30
1935	1.20	1.50	1.50	1.00	1.50	1.50	1.00
1936	1.28	1.50	1.50	1.00	1.50	1.50	1.00
1937	1.50	1.725	1.62	1.33	1.50	1.60	1.54
1938	1.50	1.886	1.70	1.50	1.50	1.75	1.60
1939	1.50	1.893	1.70	1.50	1.50	1.75	1.60
1940	1.50	1.96	1.70	1.49	1.50	1.75	1.60

Hodcarriers

	Boston	New York	Chicago	Birmingham	St. Louis	San Francisco	Seattle
1913	$0.35	$0.375	$0.40	.....	$0.4875	$0.50	.....
1914	.35	.375	.40	.....	.4875	.50	.....
1915	.35	.375	.40	.....	.4875	.50	.....
1916	.35	.375	.425	.....	.4875	.50	.....
1917	.40	.425	.45	.....	.4875	.50	.....
1918	.425	.47	.50	.....	.51	.625	.....
1919	.50	.575	.575	.....	.6375	.75	.....
1920	.70	.775	1.00	.....	.70	.93	.....
1921	.70	.875	1.00	.....	.85	1.00	$0.875
1922	.70	.875	.725	.....	.85	.71	.875
1923	.70	.95	.725	.....	1.00	.77	.93
1924	.82	1.00	.725	$0.385	1.20	.8125	.95
1925	.7625	1.00	.825	.6075	1.20	.8125	1.00
1926	.77	1.07	.88	.625	1.20	.8125	1.00
1927	.79	1.125	.925	.625	1.20	.875	1.00
1928	.805	1.125	.93125	.52	1.20	.875	1.00
1929	.85	1.15	.93	.50	1.20	.875	1.00
1930	.85	1.03125	.975	.50	1.20	.875	1.00
1931	.85	1.025	.975	.35	.875	.875	.70
1932	.70	1.00	.825	.40	1.00	.70	.80
1933	.70	.91	.....	.....	1.00	.70	.80
1934	.70	.825	.825	.....	.875	.70	1.00
1935	.70	.825	.825	.....	.875	.70	1.00
1936	.77	.825	.95	.30–.40	.875	1.00	1.00
1937	.85	1.14	1.025	.40	1.00	1.10	1.15
1938	.85	1.14	1.025	.40	1.00	1.25	1.15
1939	.85	1.14	1.025	.40	1.00	1.25	1.15
1940	.85	1.186	1.025	.40	1.00	1.25	1.15

Carpenters

	Boston	New York	Chicago	Birmingham	St. Louis	San Francisco	Seattle
1913	$0.50	$0.625	$0.65	$0.525	$0.625	$0.625	$0.56
1914	.55	.625	.65	.45	.625	.625	.56
1915	.55	.625	.65	.45	.625	.625	.56
1916	.57	.625	.70	.45	.625	.625	.56
1917	.60	.69	.70	.45	.65	.68	.65
1918	.65	.69	.70	.55	.70	.75	.825
1919	.75	.75	.80	.65	.825	.875	.93
1920	1.00	1.125	1.25	.75	1.00	1.06	1.00
1921	1.00	1.125	1.25	.75	1.25	1.125	.875
1922	1.00	1.125	1.10	.75	1.10	1.04	.875
1923	1.05	1.125	1.25	.75	1.25	1.04	1.00
1924	1.05	1.3125	1.17	.76	1.525	1.00	1.00
1925	1.0875	1.3125	1.3475	.6025	1.50	1.00	1.0825
1926	1.20	1.45	1.39	.6575	1.50	1.00	1.125
1927	1.25	1.50	1.30	.95	1.50	1.125	1.125
1928	1.279	1.50	1.50	1.00	1.50	1.125	1.125
1929	1.38	1.55	1.47	1.00	1.50	1.125	1.125
1930	1.375	1.65	1.625	1.00	1.50	1.125	1.125
1931	1.175	1.45	1.625	.60	1.50	1.125	.875
1932	1.04	1.33	1.40	.60	1.275	.96	.695
1933	1.065	1.375	1.3125	.60	1.25	.90	.73
1934	.9375	1.40	1.3125	1.00	1.25	1.05	.83
1935	.9275	1.40	1.3156	1.00	1.25	1.10	1.00
1936	.937	1.40	1.50	.88	1.25	1.12	1.00
1937	1.14	1.60	1.57	1.06	1.35	1.31	1.23
1938	1.343	1.75	1.625	1.125	1.25	1.25	1.25
1939	1.375	1.75	1.625	1.125	1.25	1.25	1.25
1940	1.375	1.81	1.625	1.125	1.333	1.25	1.25

Plasterers

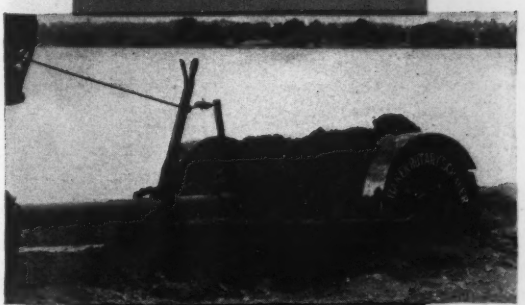
	Boston	New York	Chicago	Birmingham	St. Louis	San Francisco	Seattle
1913	$0.65	$0.69	$0.75	.....	$0.75	$0.875	$0.75
1914	.65	.69	.75	.....	.75	.875	.75
1915	.65	.69	.75	.....	.75	.875	.75
1916	.70	.75	.75	.....	.75	.875	.75
1917	.70	.75	.75	.....	.75	.875	.875
1918	.70	.75	.81	.....	.875	1.00	1.00
1919	.80	.90	.875	.....	1.00	1.125	1.125
1920	1.00	1.25	1.25	.....	1.25	1.25	1.25
1921	1.25	1.25	1.25	.....	1.375	1.375	1.25
1922	1.125	1.25	1.10	.....	1.375	1.275	1.125
1923	1.125	1.25	1.50	.....	1.50	1.275	1.25
1924	1.25	1.50	1.50	.....	1.75	1.275	1.375
1925	1.25	1.50	1.50	.....	1.75	1.50	1.375
1926	1.50	1.75	1.50	.....	1.75	1.50	1.375
1927	1.50	1.75	1.625	.....	1.75	1.50	1.375
1928	1.50	1.75	1.625	.....	1.75	1.50	1.50
1929	1.50	1.75	1.625	.....	1.75	1.375	1.50
1930	1.625	1.925	1.70	.....	1.75	1.375	1.50
1931	1.50	1.7125	1.70	$1.00	1.75	1.375	1.1875
1932	1.625	1.50	1.375	1.25	1.50	1.10	1.20
1933	1.375	1.50	1.375	.....	1.50	1.10	1.20
1934	1.231	1.50	1.50	1.00	1.50	1.38	1.18
1935	1.375	1.50	1.50	1.00	1.50	1.25	1.375
1936	1.375	1.50	1.50	1.00	1.50	1.35	1.25
1937	1.625	1.80	1.62	1.00	1.51	1.51	1.54
1938	1.625	2.00	1.70	1.00	1.58	1.65	1.60
1939	1.625	2.00	1.70	1.00	1.58	1.60	1.60
1940	1.625	2.00	1.70	1.00	1.722	1.60	1.60

Structural Ironworkers

	Boston	New York	Chicago	Birmingham	St. Louis	San Francisco	Seattle
1913	$0.625	$0.625	$0.68	$0.625	$0.65	$0.75	$0.625
1914	.625	.625	.68	.625	.65	.75	.625
1915	.625	.625	.68	.625	.65	.75	.625
1916	.625	.66	.68	.625	.675	.75	.625
1917	.68	.68	.69	.625	.70	.75	.75
1918	.80	.80	.70	.75	.80	.875	.875
1919	.80	.875	.875	.80	.925	1.00	1.00
1920	1.00	1.125	1.25	1.00	1.25	1.125	1.125
1921	1.00	1.125	1.25	.....	1.25	1.25	1.125
1922	1.00	1.125	1.05	.....	1.06	1.125	1.00
1923	1.05	1.125	1.05	1.05	1.25	1.125	1.125
1924	1.16	1.29	1.25	1.00	1.45	1.125	1.125
1925	1.1375	1.4675	1.36	1.135	1.50	1.125	1.125
1926	1.23	1.60	1.405	1.25	1.50	1.125	1.125
1927	1.25	1.75	1.50	1.55	1.50	1.375	1.155
1928	1.3125	1.75	1.50	1.75	1.50	1.375	1.215
1929	1.375	1.81	1.57	1.63	1.57	1.375	1.25
1930	1.375	1.925	1.625	1.25	1.75	1.375	1.25
1931	1.375	1.925	1.625	.75	1.75	1.375	1.1875
1932	1.205	1.675	1.375	.75	1.50	1.13	1.13
1933	1.14	1.65	1.35	.75	1.47	1.20	1.10
1934	1.20	1.62	1.35	1.00	1.47	1.375	1.13
1935	1.20	1.65	1.35	1.125	1.47	1.375	1.23
1936	1.20	1.58	1.50	1.10	1.47	1.375	1.25
1937	1.375	1.79	1.58	1.25	1.73	1.44	1.39
1938	1.479	1.925	1.70	1.25	1.75	1.50	1.50
1939	1.60	1.925	1.70	1.25	1.75	1.50	1.50
1940	1.5625	1.9625	1.70	1.302	1.75	1.60	1.50

Common Laborers

	Boston	New York	Chicago	Birmingham	St. Louis	San Francisco	Seattle
1913	$0.35	$0.225	$0.40	.....	$0.25	$0.27	$0.375
1914	.35	.225	.40	.....	.25	.31	.375
1915	.35	.25	.40	.....	.25	.31	.375
1916	.35	.25	.425	.....	.25	.31	.375
1917	.375	.30	.45	.....	.30	.375	.4375
1918	.40	.405	.50	.....	.365	.43	.56
1919	.40	.405	.575	.....	.425	.625	.6875
1920	.6875	.75	1.00	.....	.6075	.75	.75
1921	.6875	.60	1.00	.....	.6075	.81	.75
1922	.6875	.60	.725	.....	.5575	.625	.625
1923	.6875	.615	.725	.....	.6075	.625	.625
1924	.6625	.6875	.8175	$0.335	.70	.525	.625
1925	.6025	.6525	.8175	.31	.6525	.525	.5625
1926	.615	.815	.86	.30	.6525	.525	.5675
1927	.595	.90625	.8875	.325	.5875	.55	.64
1928	.6025	.90625	.90	.325	.60	.55	.678
1929	.625	.985	.92	.29	.61	.57	.70
1930	.625	1.03125	.975	.275	.6375	.6875	.70
1931	.60	.65625	.7375	.20	.6125	.59375	.60
1932	.575	.645	.665	.225	.56	.56	.485
1933	.548	.725	.784	.248	.6223	.64	.48
1934	.55	.8475	.825	.30	.7875	.64	.53
1935	.575	.68	.825	.30	.7875	.625	.60
1936	.581	.65	.95	.35	.7875	.651	.60
1937	.725	.91	.99	.35	.86	.75	.87
1938	.735	.912	1.025	.35	.663	.65	1.00
1939	.725	.912	1.025	.35	.663	.65	.908
1940	.725	.912	1.025	.35	.804	.745	.90



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567 STANFORD AVE. SPRINGFIELD, ILLINOIS

BAKER TRACTOR EQUIPMENT

BULLDOZERS, GRADEBUILDERS
ROAD ROOTERS, SCRAPERS
ROAD DISCS, MAINTAINERS
SNOW MOVING EQUIPMENT

Base Rates on Compensation Insurance for Construction—April 1, 1941

Data Compiled by Herbert L. Jamison & Co., Insurance Brokers, New York, N. Y.

Classification of Work (A)	Ala.	Ariz.	Ark.	Calif.	Colo.	Conn.	Del.	D. C.	Fla.	Ga.	Idaho	Ill.	Ind.	Iowa	Kan.	Ky.	La.	Me.	Md.	Mass.	Mich.	Minn.	Miss.(E)	Mo.	Mont.	Neb.
1. Boiler installation	3.21	8.43	11.80	5.06	5.98	4.56	3.20	5.66	4.06	3.65	4.88	4.06	3.85	3.25	5.20	4.16	8.72	4.73	4.33	5.59	6.03	5.58	9.35	6.99	6.50	6.73
2. Carpentry, private residences only	2.38	4.09	6.03	5.56	4.29	2.33	2.60	3.79	3.90	2.11	3.44	4.23	3.02	3.35	3.09	2.81	5.63	2.92	2.75	2.62	5.83	4.44	2.86	5.29	4.51	4.79
3. Carpentry, dwellings — 3 stories or less	2.38	4.09	6.03	5.56	4.29	2.33	2.60	3.79	3.90	P2.11	3.44	4.23	3.02	3.35	3.09	2.81	5.63	2.92	2.75	2.62	5.83	4.44	2.86	5.29	4.51	4.79
4. Carpentry, general	3.46	9.16	9.61	5.56	5.67	5.20	2.60	4.80	3.90	P5.73	5.60	6.11	4.44	3.35	4.52	4.49	7.23	5.48	6.04	8.27	5.83	4.44	11.50	5.29	7.18	6.25
5. Carpentry, interior trim installation	1.27	4.09	3.25	5.56	2.28	1.81	2.60	2.22	1.25	P1.48	1.86	1.82	1.42	1.40	1.72	1.55	2.47	1.87	1.72	1.90	1.98	4.44	1.99	5.29	2.39	2.62
6. Cement work, sidewalks, drives, etc	1.39	2.59	3.47	2.02	2.39	1.97	2.35	2.22	1.59	P1.62	1.99	2.01	1.51	1.54	1.87	1.63	2.65	2.03	1.83	2.56	1.89	2.40	2.61	2.91	2.49	2.81
7. Concrete const.— monolithic bridges (B)	6.23	14.26	16.98	9.18	10.15	7.36	3.65	9.93	5.75	6.57	8.74	5.79	7.37	7.98	8.13	7.42	12.80	10.36	7.27	17.56	10.60	8.76	15.87	15.27	11.61	13.87
8. Concrete const.— non-monolithic bridges (B)	3.61	8.43	11.47	5.20	5.34	5.77	3.65	4.45	5.31	3.51	5.21	4.62	3.90	3.83	5.15	5.23	8.63	5.50	6.08	6.75	6.78	5.32	9.71	8.14	6.62	8.95
9. Concrete const., general (B)	3.61	8.43	10.85	5.20	5.34	5.77	3.65	4.45	5.31	P3.51	5.21	4.62	3.90	3.83	5.96	5.23	8.63	5.50	6.08	6.75	6.78	5.32	9.71	8.14	6.62	8.95
10. Concrete const.— dwgs. to 3 stories—not mono. (B)	2.08	8.43	4.55	5.20	3.08	3.28	3.65	4.01	2.46	P1.94	2.75	2.84	2.20	1.96	2.75	2.11	3.40	4.25	3.86	6.03	3.34	1.40	6.83	4.56	3.57	3.69
11. Electrical equipment installation	1.94	4.59	5.27	3.37	3.66	3.20	.85	3.36	2.81	2.43	2.96	2.73	2.17	2.41	2.99	2.36	3.95	2.89	2.37	3.53	3.38	3.62	5.09	4.89	3.97	4.25
12. Electrical wiring — within buildings	1.19	2.68	2.91	2.57	2.13	1.65	.85	2.48	1.72	1.60	1.77	1.80	1.47	1.34	1.61	1.47	2.18	1.75	1.64	1.59	1.71	2.14	2.40	2.24	2.30	2.46
13. Excavation — earth (C)	2.63	7.76	5.09	4.63	7.72	4.41	2.45	5.23	2.76	2.24	4.95	3.56	2.46	2.71	4.62	2.52	3.78	4.46	4.57	5.61	3.68	4.29	5.34	7.76	6.49	5.13
14. Excavation — rock (C)	D3.49	11.98	D9.22	12.82	D6.65	D5.43	2.45	D7.94	D4.27	D3.93	D5.42	5.19	4.01	D3.86	D4.84	D4.64	S	D5.16	D4.77	D9.24	D5.78	D6.06	9.93	D7.69	D7.35	S
15. Glazing	3.07	6.29	7.92	5.93	5.63	4.37	1.25	5.41	3.82	3.51	4.61	4.33	3.47	3.40	4.22	3.91	5.93	4.52	4.11	3.58	4.68	5.35	3.71	6.12	6.07	6.39
16. Lathing	1.68	4.06	4.37	5.15	3.04	2.40	1.15	2.96	2.04	1.92	S	2.55	1.88	1.85	2.28	2.11	3.29	2.46	2.28	3.03	2.74	2.96	2.46	3.63	3.26	3.48
17. Masonry — brick, stone or conc. block	2.08	6.36	4.55	3.12	3.08	3.28	2.00	4.51	2.46	1.94	2.75	2.84	2.20	1.96	2.75	2.11	3.40	4.25	3.86	6.03	3.34	1.40	6.83	4.56	3.57	3.69
18. Office workers	.05	.09	.09	.08	.11	.08	.04	.09	.06	.06	.06	.07	.07	.07	.07	.07	.08	.08	.12	.06	.07	.08	.08	.07	.09	.08
19. Painting, decorating, paperhanging	2.31	4.54	5.56	5.03	4.53	2.85	2.00	4.14	2.56	2.21	3.72	2.84	3.23	2.65	3.50	3.32	4.15	3.37	3.51	M12.04	3.83	3.62	3.21	3.62	4.99	5.21
20. Painting — steel struct. and bridges	10.94	33.67	24.82	17.66	20.96	14.56	6.40	18.85	9.85	11.04	16.96	12.99	10.36	12.05	14.53	15.91	17.98	15.18	15.23	19.84	21.68	18.14	32.39	34.20	23.58	22.99
21. Plastering	1.99	4.06	4.16	5.15	3.73	2.73	1.15	3.60	2.72	2.16	3.02	2.76	2.23	2.21	2.96	2.52	3.87	2.95	2.81	3.56	2.84	3.55	2.46	4.30	4.04	4.19
22. Plumbing	1.32	2.73	3.06	2.09	2.26	1.90	.95	2.45	1.70	1.48	1.92	1.83	1.61	1.45	1.79	1.70	2.88	1.83	2.01	2.00	1.81	2.27	2.94	2.46	2.44	2.62
23. Roofing	5.54	12.98	10.81	10.41	10.53	7.57	4.25	9.17	6.79	6.91	8.72	8.44	8.44	6.62	7.57	7.10	9.95	8.46	7.39	11.83	12.96	10.29	8.42	10.67	11.66	11.75
24. Sheet metal work	1.89	5.66	5.18	10.03	3.46	2.85	1.50	3.60	2.01	2.24	2.83	2.30	2.57	2.10	2.59	2.40	3.90	2.79	2.63	1.80	2.81	3.09	6.25	3.25	3.71	3.96
25. Steel erection — general	8.20	19.46	20.03	10.23	15.90	11.45	6.40	15.25	12.16	9.29	12.88	11.85	6.59	9.06	12.21	11.39	14.54	12.17	10.66	17.41	12.46	15.02	19.66	19.31	17.35	17.55
26. Steel erection — interior ornamental	2.31	4.43	6.12	4.07	4.27	3.28	6.40	4.19	2.78	2.61	S	3.61	2.62	2.55	3.32	2.97	4.58	3.40	3.17	4.17	3.84	4.07	7.35	5.09	4.65	4.84
27. Steel erection — struct. or on outside building	10.94	33.67	24.82	17.66	20.96	14.56	6.40	18.85	9.85	11.04	16.96	12.99	10.36	12.05	14.53	15.91	17.98	15.18	15.23	19.84	21.68	18.14	32.39	34.20	23.58	22.99
28. Supervising executives (J)	.26	.88	.62	.44	.48	.36	G	.44	.31	.30	.40	.36	.30	.28	.46	.33	.46	.36	.38	.46	.41	.42	.93	.54	.53	.52
29. Tile, stone or mosaic work — interior	1.09	1.79	2.79	1.61	1.90	1.55	.85	2.30	1.27	1.24	1.56	1.58	1.21	1.21	1.58	1.31	2.13	1.59	1.47	1.87	1.61	1.93	1.39	2.18	1.97	2.22
30. Watchmen and timekeepers (I)	1.64	6.36	4.23	G	2.98	2.33	G	2.88	2.01	1.89	2.44	2.44	1.83	1.83	2.25	2.06	3.16	2.43	2.21	3.09	2.64	2.85	5.41	3.52	3.19	3.40
31. Waterproofing	2.52	5.63	6.57	4.43	4.64	3.57	W	4.43	3.04	2.87	S	3.80	2.83	2.79	3.52	3.17	4.93	3.72	3.40	4.99	4.14	4.42	3.33	5.49	4.96	5.24
32. Wrecking	11.80	35.22	30.52	26.14	21.98	15.98	12.75	20.54	14.65	13.03	S	26.54	16.59	13.12	16.85	15.96	22.71	17.50	15.75	20.56	34.15	18.78	23.44	34.35	23.90	24.81

Classification of Work (A)	Nev.(F)	N. H.	N. J.	N. M.	N. Y.	N. C.	N. D.(F)	Ohio(F)	Okla.	Ore.(H)	Pa.	R. I.	S. C.	S. D.	Tenn.	Tex.	Utah	Vt.	Va.	Wash.(H)	W. Va.(F)	Wis.	Wyo.
1. Boiler installation	State Insurance Plan Nevada Industrial Commission, Carson City, Nev.	4.44	7.90	4.43	7.33	4.05	North Dakota State Plan: Workmen's Compensation Bureau, Bismarck, N. D.	Ohio State Plan: Workmen's Compensation, The Industrial Commission of Ohio, Actuarial Section, Columbus, Ohio	9.52	9.20	6.25	6.38	7.02	3.86	3.77	5.24	9.90	2.63	3.77	7.07	West Virginia State Plan: State Compensation Commission, Charleston, W. Va.	6.07	Wyoming State Plan: Manager, Workmen's Compensation Dept., State Treasurer's Office, Cheyenne, Wyo.
2. Carpentry, private residences only		2.54	5.60	2.95	8.03	2.30			6.29	6.36	3.30	4.48	4.65	2.75	2.46	4.11	4.50	1.90	2.19	4.59		6.00	
3. Carpentry, dwellings — 3 stories or less		3.03	6.60	2.95	8.03	2.30			6.29	6.36	3.30	4.48	4.65	2.75	2.46	7.74	4.50	1.90	2.19	4.59		6.00	
4. Carpentry, general		5.54	7.50	4.89	L8.03	3.72			12.29	7.49	3.30	7.59	7.91	4.28	4.69	7.74	4.50	2.92	3.92	6.08		6.00	
5. Carpentry, interior trim installation		1.69	S	1.72	8.03	1.57			3.78	2.94	3.30	2.46	1.62	1.52	1.50	3.00	4.50	1.02	1.50	1.50		6.00	
6. Cement work, sidewalks, drives, etc		1.79	4.30	1.82	5.02	1.68			4.02	3.19	4.60	2.60	2.35	1.62	1.63	2.68	3.77	1.06	1.57	2.30		2.59	
7. Concrete const.— monolithic bridges (B)		8.26	11.10	7.96	11.70	9.24			19.88	11.58	7.45	11.40	12.48	6.89	7.51	8.21	15.41	4.56	7.98	S		11.65	
8. Concrete const.— non-monolithic bridges (B)		4.53	11.10	4.43	9.52	4.87			12.04	6.69	7.45	6.83	8.71	4.18	3.52	7.74	10.83	2.80	3.80	5.15		11.65	
9. Concrete const., general (B)		4.53	9.40	4.43	9.52	4.87			12.04	6.69	7.45	6.83	8.71	4.18	3.52	7.74	10.83	2.80	3.80	5.15		7.22	
10. Concrete const.— dwgs. to 3 stories—not mono. (B)		3.44	9.40	2.49	9.52	2.46			3.99	5.83	7.45	5.40	3.92	1.99	2.43	7.74	4.50	2.46	1.99	4.48		3.22	
11. Electrical equipment installation		2.64	3.90	2.68	4.90	2.17			4.86	4.15	1.70	3.84	3.38	2.33	2.51	4.02	4.57	1.59	2.29	3.11		3.76	
12. Electrical wiring — within buildings		1.58	2.40	1.61	3.28	1.62			3.42	3.29	1.70	2.27	2.14	1.42	1.47	2.47	2.90	.95	1.41	2.53		2.23	
13. Excavation — earth (C)		4.71	7.80	5.03	9.88	2.49			5.77	7.46	4.60	6.79	5.34	2.92	2.33	6.63	7.50	2.78	2.38	5.39		5.75	
14. Excavation — rock (C)		D4.93	10.40	D4.86	D9.99	D5.65			D10.46	S	4.60	D7.09	D9.70	S	D4.06	8.08	D10.46	D2.91	D4.10	D10.49		7.67	
15. Glazing		4.19	7.10	4.22	10.37	3.82			9.06	6.73	2.45	6.03	5.37	3.69	3.60	7.13	8.04	2.47	3.63	5.17		6.91	
16. Lathing		2.28	4.90	2.27	4.69	2.10			5.01	5.72	2.25	3.30	3.32	2.01	1.96	3.93	3.50	1.36	1.96	4.04		3.74	
17. Masonry — brick, stone or conc. block		3.64	7.70	2.49	7.99	2.46			3.99	5.83	3.90	5.40	3.92	1.99	2.43	7.74	4.50	2.46	1.99	4.48		3.22	
18. Office workers		.06	.09	.07	.10	.07			.08	.09	.07	.10	.09	.07	.07	.10	.12	.07	.06	.07		.10	
19. Painting, decorating, paperhanging		3.13	M7.10	3.31	8.75	2.56			6.21	6.67	4.35	4.33	3.59	2.97	2.19	4.07	6.29	2.01	3.01	5.13		3.83	
20. Painting — steel struct. and bridges		15.56	24.50	15.18	S	14.05			32.50	25.39	12.50	22.29	19.63	13.10	11.89	32.29	29.00	9.01	12.05	19.52		17.38	
21. Plastering		2.81	4.90	2.76	5.53	2.39			5.60	5.72	2.25	4.01	3.32	2.41	2.16	4.67	4.50	1.64	2.43	4.04		3.06	
22. Plumbing		1.76	3.20	1.90	3.90	1.76			3.66	2.91	2.10	2.55	2.31	1.57	1.47	2.83	2.50	1.09	1.52	2.24		2.68	
23. Roofing		7.83	11.60	7.83	K21.86	6.57			16.91	15.59	8.30	11.37	9.15	6.85	5.54	10.90	11.00	4.69	5.64	S		12.96	
24. Sheet metal work		2.54	D4.50	2.60	6.61	2.64			5.51	6.42	3.20	3.68	3.59	2.26	2.36	3.48	4.71	1.53	2.15	4.59		3.94	
25. Steel erection — general		11.81	20.40	11.18	26.72	11.93			30.70	S	12.50	16.90	14.62	10.01	9.87	15.16	21.10	6.86	9.28	12.98		14.19	
26. Steel erection — interior ornamental		3.21	6.80	3.18	5.71	2.90			6.99	5.94	12.50	4.60	3.46	2.80	2.71	5.46	5.75	1.87	2.70	4.57		5.17	
27. Steel erection — struct. or on outside building		15.56	24.50	15.18	42.24	14.05			32.50	25.39	12.50	22.29	19.63	13.10	11.89	32.29	29.00	9.01	12.05	19.52		17.38	
28. Supervising executives (J)		.34	.72	.36	.73	.33			.71	.75	G	.51	.68	.31	.29	G	.79	.21	.29	S		.57	
29. Tile, stone or mosaic work — interior		1.43	2.10	1.45	3.28	1.34			3.24	2.10	1.65	2.06	1.53	1.30	1.28	1.73	2.68	.86	1.27	1.62		2.14	
30. Watchmen and timekeepers (I)		2.21	S	2.23	7.38	2.04			4.82	5.45	G	3.19	2.85	1.96	1.93	G	3.84	1.33	1.94	4.69		3.60	
31. Waterproofing		3.44	6.60	3.43	7.45	3.15			7.53	4.70	W	4.97	3.80	3.02	2.97	5.93	5.98	2.04	2.96	S		5.62	
32. Wrecking		16.26	31.30	16.30	T	14.84			35.03	32.43	25.00	23.42	32.77	14.20	15.43	27.12	43.09	9.64	13.51	24.95		31.00	

Note: Base rates subject to increase or decrease according to experience ratings.

(A) Blasting payroll is assigned to operation to which blasting is incidental. (B) Includes construction of forms. (C) Does not include pile driving, caisson or cofferdam work. (D) Special rate charge for Occupational Disease. (E) Employers Liability — no Compensation Act. (F) Compensation must be carried with Monopolistic State Fund. (G) Assign to governing classification. (H) Occupations specified as hazardous in law must be insured in State Fund. (I) Not applicable if general contractor is conducting any operations on job. (J) Not applicable to supervisor of a single job or location. (K) Flat roof work $15.20 rate in N. Y. (L) Special rate for military cantonment construction. (M) Rate applies to outside work only — inside painting $1.35 in Mass.; paperhanging $1.60 in N. J.; (P) Special rates for Federal Housing projects. (S) Specially rated by Bureau. (T) Building wrecking in N. Y. rated on basis of cubic content. (W) Waterproofing rated according to type in Del., N. Y. and Pa.

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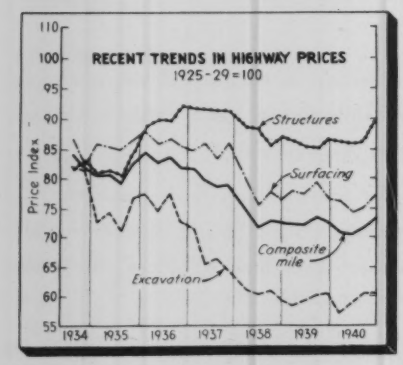
BRANCHES IN 62 OF THE COUNTRY'S PRINCIPAL CITIES

Roadbuilding Costs

FOURTH QUARTER highway costs were higher than during any other part of 1940 as measured by the index of average bid prices on federal-aid projects prepared by the Construction Division of the U. S. Public Roads Administration of the Federal Works Agency. In that quarter costs were 3.4 percent higher than at the beginning of the year. The 1940 peak matched the 1939 high in the third quarter, but the yearly average was 1.3 percent lower than in the preceding year.

The PRA index is based on average prices for the 1925–1929 period for a so-called composite mile of road, in which "composite" are included excavation, surfacing and structures. For comparative purposes quantities are considered constant, although in actual practice quantities are constantly increasing. The base quantities and prices for construction of the composite standard mile are given at the head of the accompanying table on roadbuilding price trends.

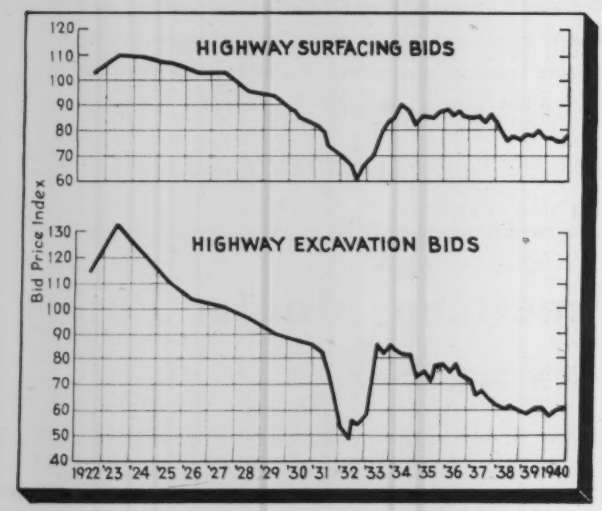
Excavation costs remained practically unchanged from 1939 at about 60 percent of the bid prices that existed in the 1925–1929 base period. Surfacing costs were at 76 percent, compared with 77 in 1939. Structures costs were 87 percent, and the composite mile 71.6 percent of the base period figure.

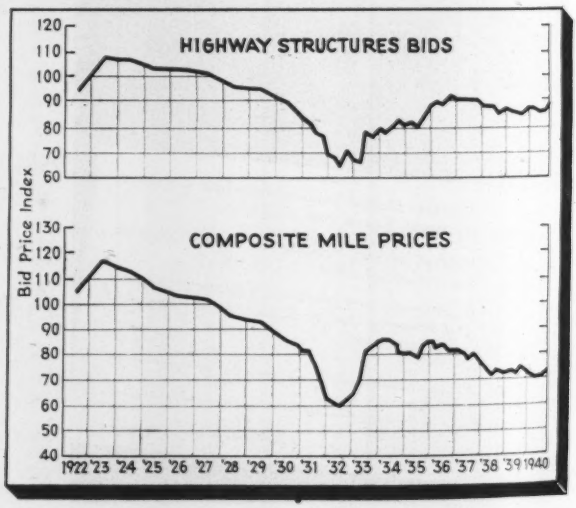


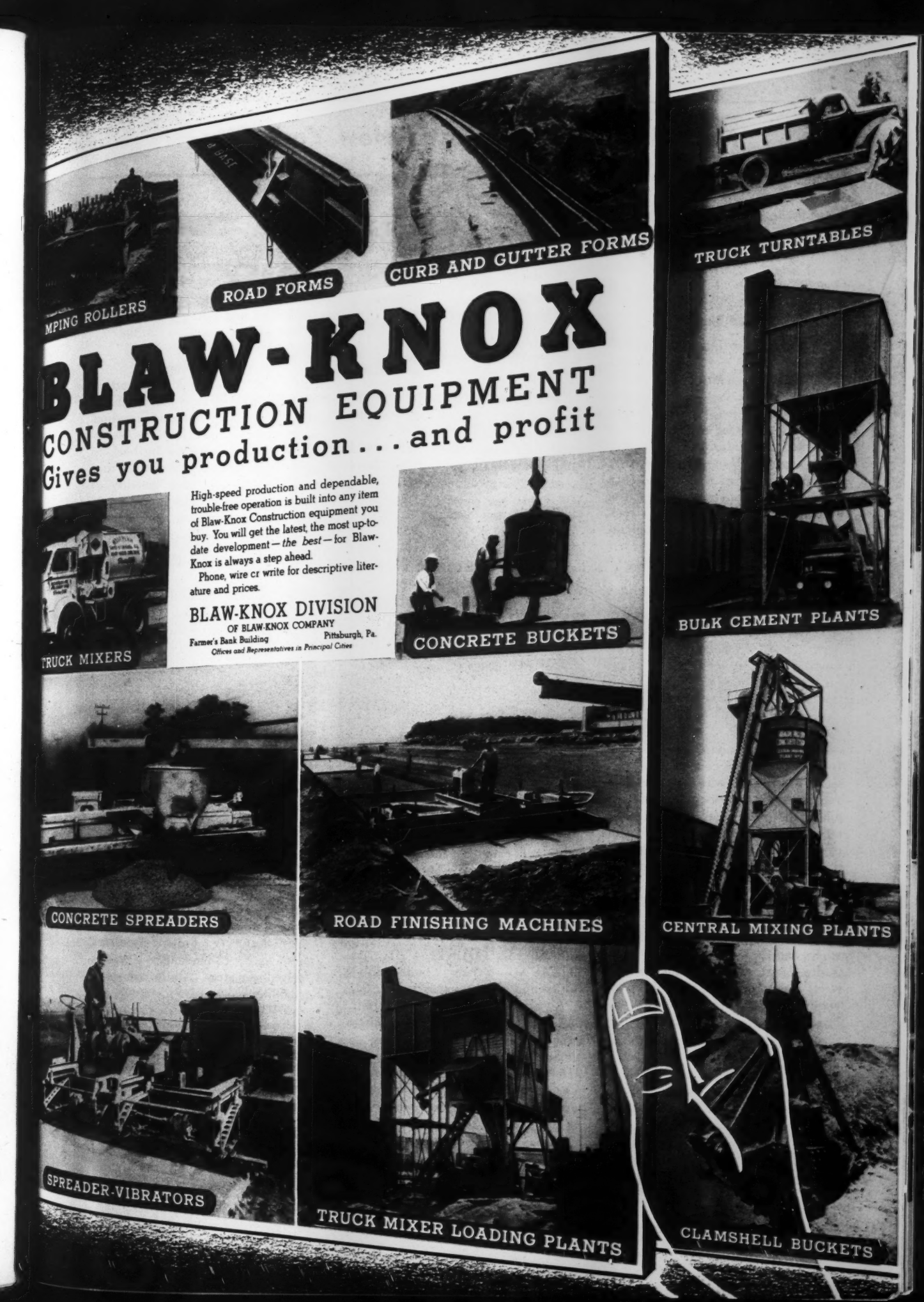
Price Trend in Highway Construction for Composite Standard Mile

Year	Excavation [1] (17,491* cubic yards)		Surfacing [2] (3,726* square yards)		Structures				Composite mile
					Reinforcing steel (16,000* pounds)	Structural steel (4,325* pounds)	Structural concrete (68* cubic yards)	Combined	
	Bid price [3]	Sub-index	Bid price [3]	Sub-index	Bid price [3]	Bid price [3]	Bid price [3]	Sub-index	Index
Base period, 1925 to 1929	$0.35†	100.0	$2.22†	100.0	$0.052†	$0.067†	$22.15†	100.0	100.0
1922	.40	114.5	2.28	102.7	.050	.074	20.18	95.1	105.8
1923	.47	133.3	2.43	109.5	.057	.078	23.37	108.6	117.9
1924	.43	122.2	2.40	108.3	.057	.077	22.91	107.2	113.2
1925	.39	110.0	2.36	106.4	.056	.067	22.53	103.9	107.3
1926	.36	103.7	2.29	103.1	.053	.074	22.76	103.7	103.4
1927	.35	100.3	2.29	103.3	.051	.071	22.65	101.5	101.9
1928	.34	96.0	2.10	94.5	.049	.067	21.22	96.1	95.3
1929	.32	90.0	2.05	92.7	.048	.059	21.58	95.0	92.1
1930	.30	86.3	1.86	84.1	.045	.061	20.08	89.4	85.7
1931	.27	77.2	1.68	75.6	.040	.054	18.02	79.9	76.8
1932	.18	52.3	1.45	65.2	.034	.046	15.32	68.0	61.0
1933	.26	73.6	1.67	75.1	.037	.046	16.15	72.1	74.1
1934	.29	82.8	1.91	86.0	.043	.053	17.73	80.8	84.0
1935									
1st Q.	.25	72.7	1.90	85.8	.044	.051	17.62	80.7	80.3
2nd Q.	.26	74.1	1.89	85.1	.044	.052	17.51	81.1	80.5
3rd Q.	.25	70.9	1.88	84.8	.044	.052	17.22	80.2	79.1
4th Q.	.27	76.9	1.91	86.2	.044	.053	18.77	84.1	82.5
1936									
1st Q.	.27	77.2	1.94	87.7	.044	.056	20.20	88.7	84.1
2nd Q.	.26	74.4	1.90	85.8	.046	.059	20.06	89.7	82.3
3rd Q.	.27	77.2	1.91	86.3	.046	.061	19.87	89.5	83.5
4th Q.	.25	72.7	1.89	85.3	.046	.062	20.87	92.0	81.8
1937									
1st Q.	.25	71.2	1.88	84.8	.047	.063	20.31	91.7	81.0
2nd Q.	.23	65.5	1.90	85.8	.049	.067	19.42	91.3	79.3
3rd Q.	.23	66.1	1.85	83.4	.049	.067	19.42	91.5	78.4
4th Q.	.22	63.8	1.91	85.9	.048	.065	19.90	91.3	78.8
1938									
1st Q.	.21	61.0	1.77	79.8	.046	.065	19.13	88.6	74.4
2nd Q.	.21	60.1	1.67	75.2	.046	.064	19.10	88.2	71.8
3rd Q.	.21	60.7	1.73	77.8	.044	.061	18.73	85.4	72.8
4th Q.	.21	59.8	1.70	76.7	.044	.060	19.29	86.7	72.2
1939									
1st Q.	.21	58.7	1.73	78.0	.043	.058	19.46	86.4	72.3
2nd Q.	.21	59.3	1.72	77.4	.043	.059	19.03	85.4	72.1
3rd Q.	.21	60.1	1.76	79.4	.043	.060	18.95	85.1	73.3
4th Q.	.21	60.4	1.71	76.9	.045	.060	19.07	86.8	72.5
1940									
1st Q.	.20	57.0	1.69	76.4	.045	.061	18.88	86.2	70.9
2nd Q.	.21	58.7	1.65	74.6	.043	.061	19.07	85.9	70.6
3rd Q.	.21	60.4	1.67	75.3	.044	.064	18.95	86.3	71.6
4th Q.	.21	60.4	1.72	77.7	.046	.066	19.79	90.0	73.3

[1] Common excavation plus other excavation items expressed as equivalent common excavation.
[2] Portland-cement concrete plus other surfacing items expressed as equivalent portland-cement concrete.
[3] Indexes and totals were calculated with the bid prices carried to 1 more decimal place than that to which they are shown in this table.
Column showing amount of bid price times fixed quantity omitted in this table.
* Fixed quantities used for establishing composite mile for price trend.
† Fixed prices used for establishing composite mile index base.



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SPREADER-VIBRATORS
TRUCK MIXER LOADING PLANTS
CLAMSHELL BUCKETS

Municipal Building Costs—New York City

The various types of buildings listed were designed, constructed and completed during 1940 under supervision of the Department of Public Works, New York, N. Y., Irving V. A. Huie, Commissioner.

Hospital Buildings

HOSPITAL ADMINISTRATION BUILDING (PWA Project)—Building 211x176-ft. with 2 open courts 67x80-ft.; 8 stories and basement; 2½-story penthouse, including elevators. Skeleton steel frame, fireproof construction. Exterior finish first story granite; Harvard brick from second story up with limestone trim. Wood sash throughout. Foundation wood piles, spread footings to rock. Airocrete slab flooring throughout.

Cubic foot cost.....$0.75
Square foot cost.....$11.06

TUBERCULOSIS HOSPITAL (PWA Project)—10-story and basement. Average frontage 430-ft., average depth 50-ft., varying with story heights. Includes new tunnel connection to existing building. Tunnel length 360-ft.; cross section 10½-ft. Also alterations to present laundry and power house buildings, including elevators involved. Steel skeleton frame, fireproof construction. Exterior finish brick with limestone trim and terra cotta back-up. Foundations pile and spread footings. Design determined by functional requirements of which major one was maximum light and air; oriented to prevailing sunlight.

Cubic foot cost.....$0.86

DISPENSARY (PWA Project)—5-story and basement; 89x139-ft. by 70-ft. deep; fireproof construction, steel skeleton frame, including elevators. Exterior finish limestone with brick backing. Foundations are spread footings.

Cubic foot cost.....$0.74
Square foot cost.....$11.14

OUT-PATIENT BUILDING—5-story and basement, 64x195-ft., and 1-story wing 70x78-ft. Fireproof construction, skeleton steel frame, including elevators. Exterior finish brick trimmed with limestone and granite base. Interior finish terra cotta and glazed tile walls. Movable metal partitions throughout. Spread footing foundations.

Cubic foot cost.....$0.79
Square foot cost.....$11.22

Health Center Buildings

HEALTH CENTER (PWA Project)—5-story, penthouse and basement. Approximately 125x45-ft. Irregular fireproof building, skeleton steel frame. Exterior finish face brick trimmed with limestone. Elevators. Spread footing foundations.

Cubic foot cost.....$0.83
Square foot cost.....$15.13

HEALTH CENTER — 4-story and basement; 124x85-ft. Fireproof construction, steel skeleton frame. Exterior finish of face brick, limestone trim. Elevators. Spread footing foundations to rock.

Cubic foot cost.....$0.63
Square foot cost.....$8.40

Court and Jail Buildings

PENITENTIARY LAUNDRY BUILDING—1-story fireproof building, 105x95-ft., 21-ft. high, unfinished basement, skeleton steel frame. Exterior finish face brick, glazed tile interior finish. Commercial projected steel windows. Flat slag roof, 2 skylights and exhaust vents. Reinforced concrete slab floor. Spread footing foundations.

Cubic foot cost.....$0.35
Square foot cost.....$4.90

COMBINED COURT AND JAIL BUILDING—Prison building 12 stories and cellar, approximately 225-ft. high; typical floor area 68x94-ft.; 833 cells and necessary administrative quarters. Courts building 17 stories and cellar, ground area 304x318-ft. Accommodates 25 court rooms plus necessary administrative quarters. Exterior treatment: polished domestic granite, 2-stories high accommodating bronze casement windows. Limestone treatment from top of granite to highest point of building. All windows in limestone walls are aluminum of casement type. Prison windows are detention type, glazed with cast glass blocks. Fireproof construction, skeleton steel frame. Foundations are pile clusters and caissons extended to bedrock.

Cubic foot cost.....$1.10
Square foot cost.....$15.53

BOROUGH HALL—Main portion 3½-stories high, rear 5 stories, basement and small penthouse. Fireproof construction, spread footings, skeleton steel frame, brick facing back-up tile walls. Limestone trim, steps and floor of main entrance portico of granite. Entrance lobby and main stairs marble; terrazzo stair treads; terrazzo floors in all public spaces. One elevator.

Cubic foot cost.....$0.41
Square foot cost.....$5.42

Miscellaneous Buildings

FIRE HOUSE—2-story brick with brick hose tower and part basement; 25x92-ft. and 40-ft. high, with 16x12-ft. hose tower 22-ft. high. Fireproof; wall-bearing steel beams; reinforced concrete floor and roof arches. Exterior front smooth red face brick with granite base and limestone trim. Side and rear walls common brick. Concrete foundation.

Cubic foot cost.....$0.68
Square foot cost.....$8.20

COLLEGE BUILDING (PWA Project)—16-story, 312x200-ft. with penthouse, basement and sub-basement. Fireproof construction; skeleton steel frame. Exterior finish limestone, granite base; 13-passenger elevators, 2 freight elevators. Auditorium seating 2,600.

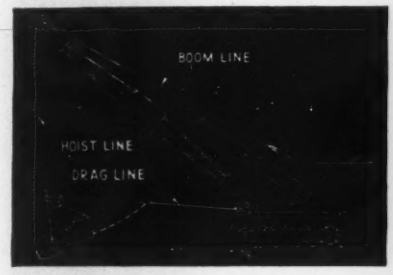
Cubic foot cost.....$0.52
Square foot cost.....$6.00

NOTE: Construction cost per cubic foot includes excavation, foundations, general construction, plumbing, heating, ventilating, electrical work, lighting fixtures, elevators, and built-in equipment. Items excluded are furniture, architects and engineering fees, and land costs.
Square foot costs are approximate and based on total floor area.

Some TIPS on choosing EXCAVATING ROPE

If the utmost in service is to be obtained from excavating rope, its construction and type of center must be properly matched to the requirements of the job. The following suggestions, while not applicable to all conditions, will serve as a general guide in selecting excavating ropes:

TYPICAL DRAGLINE EXCAVATOR

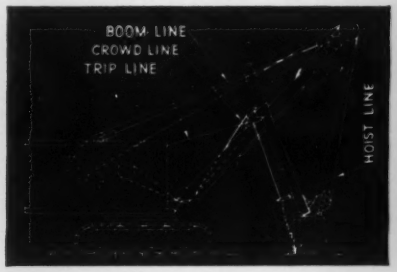


DRAG LINES are subjected more to wear than to bending fatigue. Therefore, the larger outer wires of a Bethlehem 6 x 19 Type U dragline are usually preferred. Lang Lay construction, Purple-Strand quality and IWRC are essential for this service.

HOIST LINES always travel over sheaves and are therefore affected by bending fatigue and crushing. Purple-Strand, Form-Set, 6 x 19 Type W, IWRC is recommended. Lang Lay is usually best.

BOOM LINES are more or less stationary. Ample strength is the main consideration. A Purple-Strand, 6 x 19 Type W rope, regular lay, IWRC or hemp center, is standard.

TYPICAL POWER SHOVEL



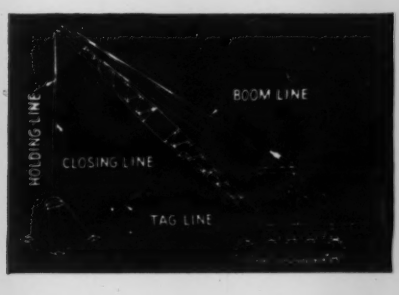
HOIST LINES must stand up under severe bending. They encounter some wear and are subjected to severe shock loads. Typical selection is a Purple-Strand, Form-Set 6 x 19 Type W rope, Lang Lay and with an IWRC.

BOOM LINES—See under Dragline Excavators.

CROWD LINES encounter bending, shock loads and wear. Purple-Strand, Form-Set, 6 x 19 Type W, Lang Lay and IWRC is often used. Some shovels require 6 x 37 flexibility.

TRIP OR DUMP LINES—8 x 19 Plow Steel, hemp core, regular lay, is satisfactory on small shovels; 6 x 19 Type W is preferable on large ones.

TYPICAL CLAMSHELL CRANE



HOISTING LINE—6 x 19 Type W Purple-Strand rope, regular lay, hemp core, is usually recommended.

HOLDING AND CLOSING LINES often encounter severe bending and severe crushing. The 6 x 19 Type W construction is usually used. IWRC is generally required. Invariably the rope is regular lay, Purple-Strand. Usually it is Form-Set.

BOOM LINES—See under Dragline Excavators.

TAG LINES—Generally 8 x 19 Plow Steel, regular lay, hemp center lines are used.

Bethlehem produces a full line of ropes for all types of excavating. These ropes are quality built, through and through. Their performance on your job will convince you of their economy and full dependability.

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Small House Costs

THE CUBIC-FOOT COST of building the same standard house in 80 representative U. S. cities is computed by the Federal Home Loan Bank Board. The cities reporting are divided into 3 groups or cycles, of which one cycle is given each month. Thus, the costs in each city are available four times a year.

In determining the cubic content of the house, length and width are taken as the actual measurement of the outside walls. Height is the distance from 6 inches below the finished surface of cellar floor to a point halfway between roof ridge and attic floor beams. Multiplying these factors gives the gross cube.

The house on which costs are reported is a detached 6-room home of 24,000-cu.ft. volume. Living room, dining room, kitchen and lavatory on first floor; 3 bedrooms and bath on second floor. Exterior is wide-board siding with brick and stucco as features of design. Best quality materials and workmanship are used.

The house is not completed ready for occupancy. It includes all fundamental structural elements, an attached 1-car garage, an unfinished cellar, an unfinished attic, a fireplace, essential heating, plumbing and electric wiring equipment, and complete insulation. It does not include wall-paper nor other wall or ceiling finish on interior plastered surface, lighting fixtures, refrigerators, water heaters, ranges, screens, weather stripping, nor window shades.

Reported costs include, in addition to material and labor costs, compensation insurance, an allowance for contractor's overhead and transportation of materials, plus 10 per cent for builder's profit.

Reported costs do not include the cost of land nor of surveying the land, the cost of planting the lot, nor of providing walks and driveways; they do not include architect's fee, cost of building permit, financing charges, nor sales costs.

In figuring costs, current prices on the same building materials list are obtained every three months from the same dealers, and current wages are obtained from the same reputable contractors and builders.

Small House Costs—Cents Per Cubic Foot

Federal Home Loan Bank Board

	1938				1939				1940				1941
	JAN.	APR.	JULY	OCT.	JAN.	APR.	JULY	OCT.	JAN.	APR.	JULY	OCT.	JAN.
Albany, N. Y.	.246	....	.236	.232	.228	.233	.230	.233	.234	.237	.235	.236	.257
Atlantic City, N. J.	.247	....	.247	.246	.241	.239	.244	.261	.261	.253	.249	.257	.264
Boise, Idaho	.247	.244	.244	.250	.253	.257	.257	.255	.259	.261	.261	.268	.274
Buffalo, N. Y.	.246	.238	.242	.247	.240	.236	.234	.246	.237	.238	.238	.239	.256
Camden, N. J.	.238	.237	.238	.232	.233	.237	.232	.243	.248	.248	.248	.261	.267
Casper, Wyo.	.272	.270	.269	.268	.269	.272	.272	.275	.268	.261	.251	.261	.269
Des Moines, Iowa	.261	.256	.255	.257	.262	.261	.262	.263	.264	.264	.265	.267	.279
Detroit, Mich.	.254	.251	.256	.257	.258	.255	.255	.247	.242	.243	.243	.251	.238
Duluth, Minn.	.260	.258	.258	.258	.249	.250	.250	.252	.258	.258	.257	.257	.261
Evansville, Ind.	.240	.240	....	.239	.244	.240	.246	.254	.255	.255	.255	.263	.271
Fargo, N. D.	.248	.245	.243	.243	.236	.236	.234	.243	.244	.244	.240	.242	.257
Grand Rapids, Mich.	.246	.246	.246	.245	.246	.243	.243	.236	.229	.230	.236	.245	.267
Great Falls, Mont.	.292	.297	.296	....	.291	.293	.289	.287	.290	.288	.287	.287	.298
Indianapolis, Ind.	.238	.242	.242	.240	.243	.249	.248	.239	.233	.229	.229	.231	.266
Kansas City, Mo.	.243	.239	.240	....	.242	.248	.255	.248	.251	.250	.245	.242	.272
Newark, N. J.	.223	.226	.228	.231	.231	.231	.229	.236	.238	.238	.238	.239	.252
Portland, Ore.	.222	.218	.212	.219	.221	.212	.214	.220	.223	.223	.225	.235	.225
St. Louis, Mo.	.237	.231	.227	.228	.231	.230	.226	.230	.234	.232	.232	.233	.241
St. Paul, Minn.	....	.272	.273	.272	.272	.274	.273	.273	.272	.271	.270	.271	.275
Salt Lake City, Utah	.252	.248	.246	.245	.245	.251	.251	.250	.251	.251	.250	.254	.265
Seattle, Wash.	.271	.268	.261	.261	.261	.263	.261	.263	.263	.265	.264	.269	.286
Sioux Falls, S. D.	.264	.258	.266	.268	.261	.259	.251	.252	.254	.257	.257	.258	.254
South Bend, Ind.	.242	.232	.223	.223	.226	.229	.231	.244	.242	.246	.246	.253	.271
Spokane, Wash.	.273	.273	.276	.262	.250	.254	.255	.262	.263	.263	.263	....	.287
Utica, N. Y.	....	....	.230	.236	.239	.247	.238	.241	.243	....	.249	.251	.256
White Plains, N. Y.	.235	.232	....	.231	.231	.229	.226	.231	.233	.233	.226	.233	.263

	1938				1939				1940				1941
	FEB.	MAY	AUG.	NOV.	FEB.	MAY	AUG.	NOV.	FEB.	MAY	AUG.	NOV.	FEB.
Albuquerque, N. M.	.274	.275	.277	.272	.272	.267	.267	.263	.261	.259	.261	.282	.291
Charleston, W. Va.	.259	.248	.246	.245	.244	.244	.242	.243	.243	.244	.242	.248	.256
Cincinnati, Ohio	.248	....	.243	.233	.229	.230	.229	.232	.230	.230	.232	.239	.239
Cleveland, Ohio	.274	....	.267	.267	.268	.270	.270	.285	.283	.279	.287	.290	.287
Columbus, Ohio	.237	.237	.247	.239	.237	.235	.234	.241	.242	.242	.242	.240	.246	.249
Dallas, Tex.	....	.242	.245	.239	.235	.228	.226	.222	.226	.226	.226	.251	.276
Harrisburg, Pa.	.242	.243	.237	.237	.238	.238	.239	.254	.245	.245	.247	.273	.281
Houston, Tex.	.249	.245	.250	.246	.246	.246	.245	.244	.247	.246	.237	.271	.276
Jackson, Miss.	.253	.255	.253	.253	.251	.246	.246	.251	.251	.254	.254	.247	.253
Lexington, Ky.	.225	.222	.222	.228	.236	.235	.238	.246	.246	.236	.232	.228	.231
Little Rock, Ark.	.215	.215	.215	.217	.216	.218	.218	.216	.216	.215	.214	.217	.216
Los Angeles, Cal.	.245	.238	.238	.228	.225	.220	.218	.221	.219	.219	.219	.229	.230
Louisville, Ky.	.220	.214	.216	.218	.218	.219	.218	.225	.225	.227	.226	.227	.262
Memphis, Tenn.	.221	.222	.221	.224	.227	.222	.220	.226	.225	.225	.223	.233	.255
Nashville, Tenn.	.214	.209	.212	.213	.212	.208	.206	.209	.207	.206	.203	.221	.231
New Orelans, La.	.248	.248	.244	.242	.237	.235	.235	.244	.243	.240	.238	.251	.253
Philadelphia, Pa.	.230	.232	.226	.224	.225	.226	.229	.233	.233	.236	.242	.263	.263
Phoenix, Ariz.	.279	.274	.270	.269	.257	.252	.255	.259	.258	.258	.258	.282	.287
Pittsburgh, Pa.	.271	.280	.270	.267	.269	.267	.268	.267	.261	.256	.256	.268	.282
Reno, Nev.	.276	.273	.273	.274	.274	.273	.274	.279	.281	.282	.282	.281	.292
San Antonio, Tex.	.254	.252	.252	.247	.245	.245	.244	.237	.233	.229	.228	.243	.274
San Diego, Cal.	.254	.244	.243	.243	.241	.238	.234	.228	.226	.221	.222	.254	.253
San Francisco, Cal.	.265	.264	.264	.265	.266	.265	.263	.263	.263	.262	.260	.265	.265
Wheeling, W. Va.	....	.262	.252	.250	.258	.262	.263	.264	.263	.264	.253	.272	.268
Wilmington, Del.	.246	.246	.246	.246	.240	.233	.226	.225	.225	.218	.217	.251	.261

	1938				1939				1940				1941
	MAR.	JUNE	SEPT.	DEC.	MAR.	JUNE	SEPT.	DEC.	MAR.	JUNE	SEPT.	DEC.	MAR.
Asheville, N. C.	.225	.216	.212	.211	.212	.203	.202	.213	.208	.207	.206	.222	....
Atlanta, Ga.	.216	.217	.211	.209	.203	.201	.200	.205	.205	.203	.203	.231	....
Baltimore, Md.	.202	.197	.196	.195	.195	.198	.196	.200	.198	.198	.205	.236	....
Birmingham, Ala.	.253	.253	.244	.236	.236	.221	.215	.216	.217	.211	.222	.254	....
Boston, Mass.	.258	.253	.262	.266	.266	.262	.264	.268	.270	.270	.270	.278	....
Chicago, Ill.	.293	.288	.284	.285	.285	.285	.282	.283	.283	.282	.285	.288	....
Columbia, S. C.	.198	.199	.203	.204	.202	.199	.197	.195	.197	.194	.195	.227	....
Cumberland, Md.	.233	.231	.230	.227	.230	.231	.228	.228	.235	....	....	.243	....
Denver, Colo.	.273	.269	.274	.268	.265	.266	.262	.259	.259	.254	.255	.264	....
Hartford, Conn.	.243	.236	.242	.245	.244	.243	.243	.246	.247	.251	.245	.261	....
Manchester, N. H.	.227	.225	.226	.231	.229	.226	.222	.224	.225	.225	.226	.240	....
Milwaukee, Wis.	.242	.240	.240	.240	.249	.250	.248	.252	.253	.253	.261	.278	....
New Haven, Conn.	.240	.234	.234	.234	.235	.233	.236	.241	.244	.245	.245	.257	....
Oklahoma City, Okla.	.244	.243	.243	.245	.245	.244	.246	.250	.252	.255	.254	.266	....
Omaha, Neb.	.243	.242	.242	.238	.241	.241	.248	.253	.257	.256	.246	.249	....
Oshkosh, Wis.	.252	.252	.246	.246	.245	.247	.246	.242	.246	.243	.244	.261	....
Peoria, Ill.	.279	.279	.270	.268	.268	.273	.277	.288	.293	.295	.296	.298	....
Portland, Me.	.231	.230	.221	.219	.219	.221	.219	.218	.219	.219	.220	.220	....
Providence, R. I.	.250	.247	.246	.246	.247	.250	.248	.250	.251	.253	.255	.259	....
Raleigh, N. C.	.227	.226	.221	.220	.219	.206	.202	.216	.209	.209	.217	.219	....
Richmond, Va.	.222	.219	.211	.212	.212	.206	.208	.206	.202	.201	.206	.226	....
Roanoke, Va.	.211	.211	.212	.212	.214	.215	.215	.216	.217	.217	....	.238	....
Rutland, Vt.	.239	.236	.231	.228	.228	.226	.223	.220	.222	.222	.226	.227	....
Salisbury, N. C.	.196	....	.198	.198	.197	.195	.194	.203	.203	.203	.189	.187	....
Springfield, Ill.	.290	.290	.284	.284	.284	.283	.282	.295	.295	.298	.299	.309	....
Tampa, Fla.	.236	.234	.231	.230	.231	.232	.232	.238	.239	.236	.238	.253	....
Washington, D. C.	.249	.250	.243	.244	.242	.236	.239	.239	.239	.239	.246	.267	....
West Palm Beach, Fla.	.261	.257	.242	.243	.241	.241	.238	.239	.243	.252	.256	.280	....
Wichita, Kan.	.237	.244	....	.249	.254	.251	.250	.241	.240	.243	....	.238	....

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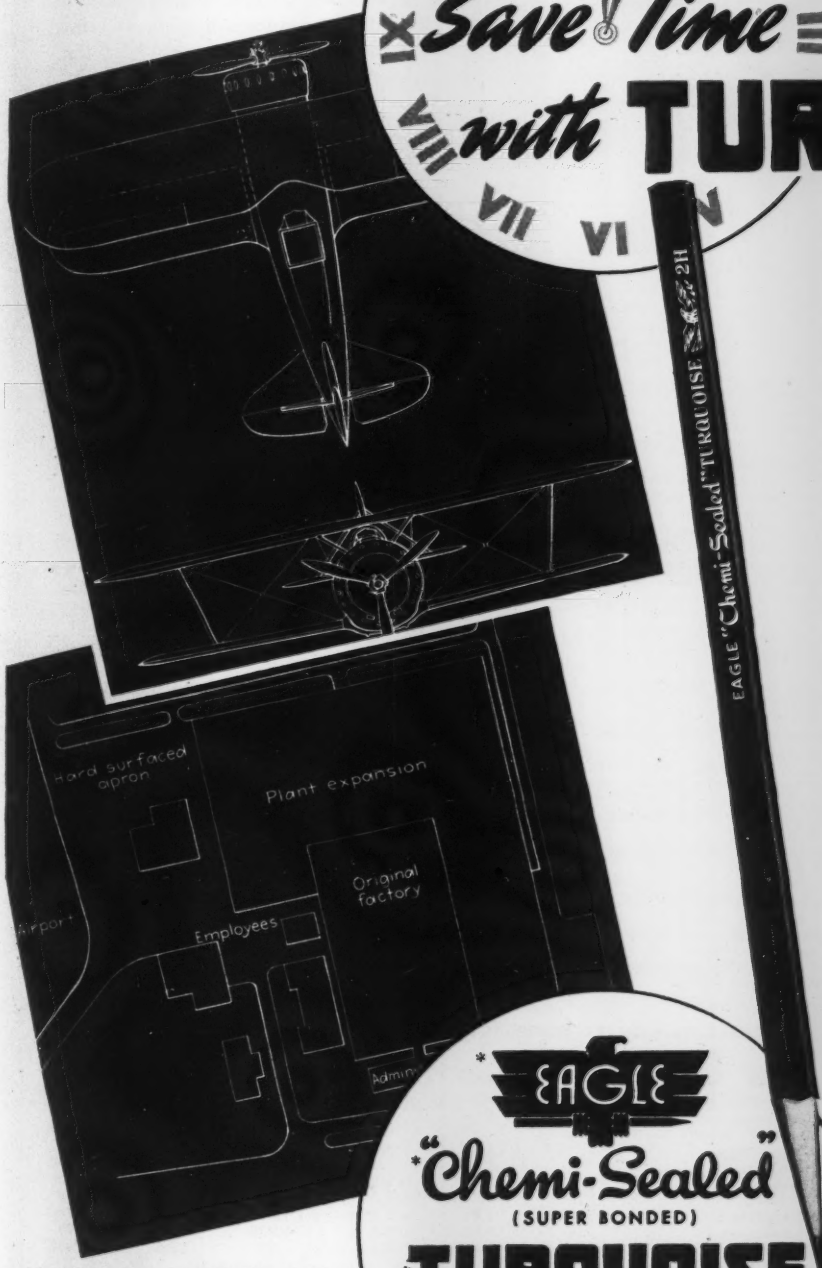

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Trend of Building Costs in Chicago

In 1935 the Chicago Real Estate Board made a study of building costs in Chicago, resulting in an unusually complete cost manual compiled by Eugene and Max Fuhrer, architects-engineers. The manual included 44 general classifications and many subclassifications of buildings. Costs were given in units of square feet, cubic feet, and room or apartment. Each cost item was subject to a long list of additions and deductions based upon various designs, number of stories, kinds of materials used, finishes, etc.

In 1938 the manual was revised. Studies were made of cost changes in each class of structure, and increased costs, in percentages, were compiled to be added to each basic cost item. A second revision, also in percent of increase to be applied to the 1935 figures, has just been compiled, as of Feb. 1, 1941.

As the basic 1935 cost items run into thousands of figures, they cannot be reproduced here. However, to indicate the trend of building costs in Chicago, the percent increases over the basic costs in 1935 as found in 1938, and again in 1941, are shown for major building classifications in Table 1. As a further indication of Chicago building cost trends, hourly wage scales and prices of principal materials in 3-year intervals since 1926, taken from the 1941 revision, are given in Tables II and III.

These latest figures reveal increases over 1935 in steel, brick and concrete buildings ranging from 20 to 28 percent, and gains in frame type construction ranging from 21 to 31 percent.

Industrial type buildings top their 1935 construction costs from 21 to 26 percent; fireproof apartment and hotel building costs are up 22 percent; office buildings are 26 to 27 percent higher; theater construction up 21 to 23 percent; combination bank and office buildings, multi-story, up 27 percent; hospital construction costs gain 23 percent; and educational buildings, up 24 percent.

All classifications of construction labor listed in the table are substantially above their respective 1935 levels. Material costs are mixed, with brick, tile, lumber and structural steel higher than six years ago, and cement, gravel, sand and plaster below their 1935 prices.

This information is re-published through the courtesy of Eugene and Max Fuhrer and Roger P. Minwegan, chairman, board of governors, appraisal division, The Chicago Real Estate Board. The original and revised cost manuals may be obtained at the Board's offices, 32 West Randolph St., Chicago.

TABLE I—INCREASES IN 1938 AND 1941 OVER CHICAGO BUILDING COSTS OF 1935

Building Classification	Increase Over 1935 — Percent — Mar. 1, 1938		Feb. 1, 1941	
	Steel, Brick, Concrete	Frame	Steel, Brick, Concrete	Frame
Bungalows, med. grade residences	16	17	23	27
High grade residences	15	15	23	24
Flats, apartment buildings	15	16	21	23
Fireproof apartment bldgs	14	..	22	..
Hotels, ordinary, slow-burning	15	..	23	..
Hotels, modern fireproof	14	..	22	..
Stores, 1-story	16	17	23	25
Stores, flats, office, loft, 2 and 3-story	16	17	23	25
Stores, 2 and 4-story, with apts., offices or lofts, fireproof	15	..	22	..
Garage, private	15	16	22	25
Garage, 1-story public	15	..	23	..
Garage, 2-story	16	..	24	..
Garage, multiple-story	15	..	24	..
Gasoline filling, parking, service station	14	..	20	..
Department store, mill const	16	..	28	..
Department store, fireproof	15	..	27	..
Office bldg., old style	16	..	26	..
Office bldg., modern, 2 to 10-story	16	..	27	..
Office bldg., modern, multi-story	15	..	27	..
Shed, 1-story frame	..	17	..	30
Steel buildings, 1-story	25	..	25	..
Industrial bldg., 1-story brick	15	..	22	..
Ind. bldg., 2 or more story, ordinary const	16	..	21	..
Ind. bldg., 2 or more story, mill const	15	..	26	..
Ind. bldg., 2 or more story, fireproof const	14	..	21	..
Greenhouse	15	15	20	21
Farm bldgs.	16	18	23	27
Golf, country club houses	15	16	23	26
Lodge bldgs.	15	..	25	..
City club bldg., slow-burning	15	..	25	..
City club bldg., fireproof	14	..	24	..
Theatre, less than 1,000 seats	15	..	21	..
Theatre, over 1,000 seats	14	..	23	..
Bank bldg.	16	..	24	..
Bank and office bldg., multi-story	15	..	27	..
Undertaker's parlors	16	..	24	..
Hospital, ordinary or slow-burning	15	..	22	..
Hospital, fireproof	14	..	23	..
Churches, temples	15	17	22	25
Dance hall, road houses	16	18	24	31
Large ballrooms, slow-burning	15	..	24	..
Large ballrooms, fireproof	14	..	24	..
Educational bldgs.	15	..	24	..

TABLE II—HOURLY WAGE SCALES, CHICAGO METROPOLITAN AREA

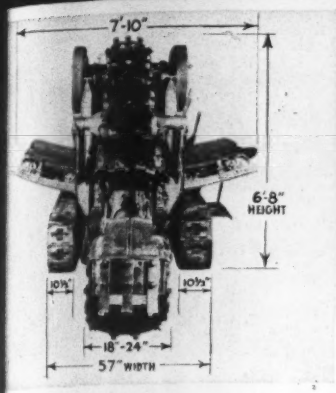
Trade	1926	1929	1932	1935	1938	Jan. 1941
Bricklayers	$1.625	$1.70	$1.375	$1.50	$1.70	$1.70
Carpenters	1.50	1.625	1.3125	1.3125	1.625	1.625
Common labor	.90	.975	.825	.825	1.025	1.025
Electricians	1.5625	1.70	1.50	1.50	1.70	1.70
Painters	1.50	1.625	1.41	1.333	1.667	1.667
Plasterers	1.625	1.70	1.375	1.50	1.70	1.70
Plumbers	1.50	1.625	1.375	1.375	1.60	1.70
Steamfitters	1.375	1.70	1.375	1.375	1.70	1.70
Ironworkers	1.50	1.625	1.355	1.355	1.70	1.70
Glaziers	1.50	1.675	1.70	1.70	1.943	1.943

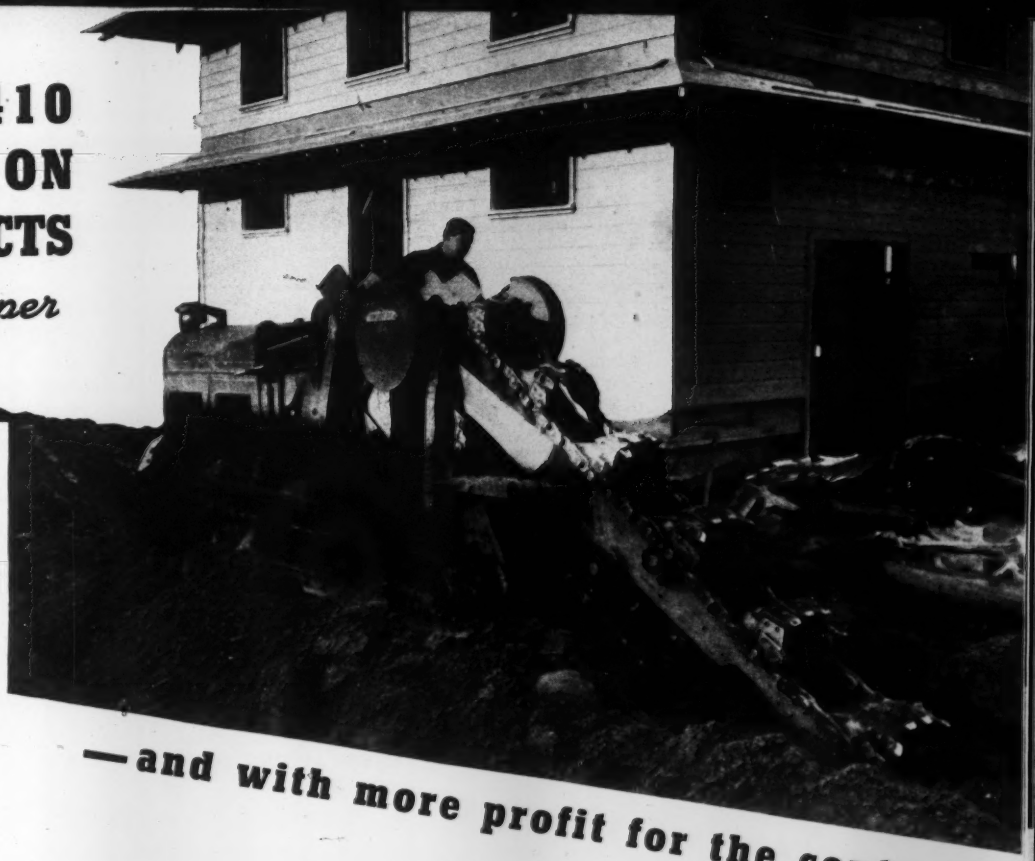
TABLE III—UNIT PRICES OF BUILDING MATERIALS, CHICAGO

Material	1926	1929	1932	1935	1938	Jan. 1941
Common brick, M	$12.00	$12.00	$10.20	$10.20	$10.50	$10.30
Cement, bbl.	2.35	1.75	1.80	2.45	2.20	2.25
Gravel, cu.yd.	2.75	1.75	2.25	2.60	2.00	1.85
Torpedo sand, cu.yd.	2.75	1.75	2.25	2.45	2.00	1.85
Gypsum plaster, ton	20.00	17.00	15.00	17.00	15.00	14.00
Clay tile, 4 in., M ft	94.00	70.00	54.20	70.40	70.40	72.60
Lumber, M fbm.	48.00	40.00	35.00	48.50	52.00	57.60
Struct. steel shapes, f.o.b. Chgo.	2.10	2.03	1.69	1.85	2.30	2.10

BUCKEYE ✓ 410 DIGS TRENCH ON DEFENSE PROJECTS

Faster and Cheaper





—and with more profit for the contractor

Buckeye 410's are doing a whirlwind trenching job on Uncle Sam's army camps, airports and emergency industrial and housing construction projects. Trenching that so often lags on such projects keeps right up with or ahead of other work when a 410 is on the job.

The small, compact 410 is a fast trencher for sewer, water and gas pipe and drainage tile. It makes trench up to 2′ wide and 6′ deep (7′6″ optional equipment). It's light on its feet, easy on lawns and roads—only 6 lbs. ground pressure per sq. inch—it trenches in close quarters between buildings, close to foundations—only 7′10″ wide overall, readily clears overhead obstructions—only 6′8″ high.

The 410 digs forward or reverse—undercuts walks, roadways and existing pipe and roughs out manholes. It gets around fast on the job—2.67 m.p.h. road speed. Handles like a car—full automatic controls and starter. Low operating cost 50 h.p. engine, constant center bucket line drive and other features galore that are bankable for contractors on defense and other projects. Let us rush you a copy of Bulletin 45—it gives the complete Model 410 story!

BUCKEYE TRACTION DITCHER CO.
Findlay, Ohio

See Other Cost-Cutting Buckeye Equipment on Pages 22-23

Built by Buckeye ✓

Convertible Shovels

Trenchers

Tractor Equipment

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Unit Costs—Transit Buildings

THE NEW YORK CITY Board of Transportation has made available to *Engineering News-Record* the complete breakdown of unit bid costs of the five bidders on their Pitkin Avenue Yard inspection shed and service buildings. Bids were asked on this project February 11, 1941. Contract awarded to the low bidder March 20. These buildings are to be of brick, concrete and steel, and are located in Brooklyn on city property bounded by Sutter Avenue, Elderts Lane, Linden Boulevard and Lincoln Avenue.

Work to be done under this contract is construction of inspection shed, maintenance buildings, substation (including shop and garage), signal tower, circuit breaker houses, oil house, heater room, gate house, pump house, flood light towers, maintenance quarters, roadways, ducts, concrete fence, installation of tracks in shed, plumbing and drainage, water, gas and electric services, and fire protection. Contractor is also required to construct concrete sewer in Linden Boulevard from the Yard to 79th St. in Queens.

Fifteen months is to be allowed for completion of work. Prevailing wages to be paid.

The amounts bid by each of the five bidders were as follows:

1. $1,055,687.00
2. 1,056,535.50
3. 1,110,042.00
4. 1,130,655.50
5. 1,395,993.50

Alternates were allowed for the railroad duct work, either vitrified clay, or asbestos-cement. The contract was awarded on the basis of the former, and the bid totals above are also on that basis.

BID TABULATION — PITKIN AVENUE YARD BUILDINGS

		UNIT PRICES									
		(1) Thos. J. Waters & Sons, Inc., New York, N. Y.		(2) Cauldwell-Wingate Co., New York, N. Y.		(3) P. J. Carlin Const. Co., New York, N. Y.		(4) National Excavation Corp., New York, N. Y.		(5) Rusciano & Son Corp., Bronx, N. Y.	
ITEM	Quan.	Price	Amt.	Price	Amt.	Price	Amt.	Price	Amt.	Price	Amt.
1. Earth excavation	85,000 c.y.	$0.80	$68,000.00	$0.80	$68,000.00	$0.90	$76,500.00	$0.80	$68,000.00	$0.75	$63,750.00
2. Concrete masonry	14,000 c.y.	18.00	252,000.00	15.50	217,000.00	17.50	245,000.00	20.00	280,000.00	19.00	266,000.00
3. Finished surf. on concrete	165,000 s.f.	.07	11,550.00	.07	11,550.00	.07	11,550.00	.08	13,200.00	.12	19,800.00
4. Masonry gutters	800 s.f.	.60	480.00	.80	640.00	.25	200.00	.50	400.00	1.00	800.00
5. Riveted steel, beams and shapes	775 ton	135.00	104,625.00	115.00	89,125.00	130.00	100,750.00	150.00	116,250.00	140.00	108,500.00
6. Steel reinforcing bars	400 ton	100.00	40,000.00	120.00	48,000.00	120.00	48,000.00	120.00	48,000.00	125.00	50,000.00
7. Misc. iron castings	60 ton	145.00	8,700.00	110.00	6,600.00	200.00	12,000.00	140.00	8,400.00	300.00	18,000.00
8. 1½-in. steel pipe sleeves, anch. bolts	200 l.f.	.20	40.00	.25	50.00	.30	60.00	.15	30.00	.30	60.00
9. 2½-in. steel pipe sleeves, anch. bolts	1,000 l.f.	.30	300.00	.35	350.00	.40	400.00	.25	250.00	.40	400.00
10. 1½-in. st. pipe sleeves; other than anch. bolts	1 ea.	1.00	1.00	1.00	1.00	2.00	2.00	1.00	1.00	3.00	3.00
11. 3-in. as above	1 ea.	1.00	1.00	1.50	1.50	3.00	3.00	1.00	1.00	5.00	5.00
12. 6-in. as above	3 ea.	1.00	3.00	2.00	6.00	4.00	12.00	2.00	6.00	8.00	24.00
13. 8-in. as above	5 ea.	2.00	10.00	2.50	12.50	5.00	25.00	2.00	10.00	10.00	50.00
14. 10-in. as above	2 ea.	2.00	4.00	3.00	6.00	6.00	12.00	2.00	4.00	16.00	32.00
15. 6-in. cast iron pipe sleeves	28 ea.	2.00	56.00	2.00	56.00	9.00	252.00	1.50	42.00	8.00	224.00
16. 8-in. cast iron pipe sleeves	10 ea.	2.00	20.00	2.50	25.00	12.00	120.00	2.00	20.00	10.00	100.00
17. 10-in. cast iron pipe sleeves	2 ea.	2.00	4.00	3.00	6.00	15.00	30.00	2.00	4.00	16.00	32.00
18. Three ply waterproofing	1,600 s.y.	1.00	1,600.00	1.00	1,600.00	1.50	2,400.00	80.00	1,280.00	1.50	2,400.00
19. Conc. masonry damp-proofing	200 s.y.	.60	120.00	.60	120.00	.60	120.00	.30	60.00	.80	160.00
20. Concrete piles	22,000 l.f.	1.90	41,800.00	2.00	44,000.00	1.90	41,800.00	2.00	44,000.00	2.00	44,000.00
21. Vit. clay RR ducts, one way	88,000 duct.f.	.25	22,000.00	.25	22,000.00	.35	30,800.00	.20	17,600.00	.25	22,000.00
22. Asbes.-cem. RR ducts, one way	88,000 duct.f.	.30	26,400.00	.30	26,400.00	.45	39,600.00	.35	30,800.00	.20	17,600.00
23. 3½-in. fibre tunnel ducts	175 duct.f.	.40	70.00	.30	52.50	.40	70.00	.40	70.00	.40	70.00
24. 4-in. fibre tunnel ducts	5,200 duct.f.	.40	2,080.00	.40	2,080.00	.50	2,600.00	.30	1,560.00	.50	2,600.00
25. 3-in. wooden electric ducts	2,000 duct.f.	.50	1,000.00	.40	800.00	.70	1,400.00	.40	800.00	1.50	3,000.00
26. 3-in. cast iron pipe	20 l.f.	2.00	40.00	1.70	34.00	1.70	34.00	2.00	40.00	2.00	40.00
27. 4-in. cast iron pipe	360 l.f.	2.00	720.00	2.00	720.00	1.70	612.00	1.70	612.00	2.25	810.00
28. 6-in. cast iron pipe	3,500 l.f.	1.50	5,250.00	2.20	7,700.00	1.60	5,600.00	1.40	4,900.00	2.75	9,625.00
29. 8-in. cast iron pipe	1,600 l.f.	2.00	3,200.00	2.40	3,840.00	2.00	3,200.00	1.80	2,880.00	3.70	5,920.00
30. 10-in. cast iron pipe	200 l.f.	3.00	600.00	2.60	520.00	2.50	500.00	2.40	480.00	5.00	1,000.00
31. 12-in. cast iron pipe	1,200 l.f.	4.00	4,800.00	3.00	3,600.00	3.20	3,840.00	3.00	3,600.00	6.00	7,200.00
32. 14-in. cast iron pipe	300 l.f.	4.00	1,200.00	3.50	1,050.00	3.60	1,080.00	3.40	1,020.00	7.50	2,250.00
33. 16-in. cast iron pipe	250 l.f.	5.00	1,250.00	4.60	1,150.00	4.80	1,200.00	4.30	1,075.00	9.00	2,250.00
34. 18-in. cast iron pipe	170 l.f.	6.00	1,020.00	5.60	952.00	5.80	986.00	5.20	884.00	10.00	1,700.00
35. 20-in. cast iron pipe	500 l.f.	8.00	4,000.00	6.70	3,350.00	6.80	3,400.00	6.00	3,000.00	12.00	6,000.00
36. 24-in. cast iron pipe	600 l.f.	9.00	5,400.00	9.00	5,400.00	9.00	5,400.00	9.00	5,400.00	14.00	8,400.00
37. 30-in. cast iron pipe	700 l.f.	13.00	9,100.00	12.50	8,750.00	12.50	8,750.00	12.00	8,400.00	20.00	14,000.00
38. 36-in. cast iron pipe	480 l.f.	18.00	8,640.00	17.00	8,160.00	16.00	7,680.00	15.00	7,200.00	25.00	12,000.00
39. 12-in. cast iron pipe	5,000 l.f.	3.00	15,000.00	2.80	14,000.00	2.70	13,500.00	2.50	12,500.00	4.00	20,000.00
40. 12-in. cast iron pipe	470 l.f.	1.00	470.00	1.10	517.00	1.20	564.00	1.00	470.00	1.50	705.00
41. 4-in. cem. lined std. steel pipe	1,400 l.f.	1.30	1,820.00	1.40	1,960.00	1.40	1,960.00	1.20	1,680.00	2.00	2,800.00
42. 6-in. cem. lined std. steel pipe	1,760 l.f.	2.20	3,872.00	2.10	3,696.00	2.10	3,696.00	2.00	3,520.00	3.00	5,280.00
43. 8-in. cem. lined std. steel pipe	5,000 l.f.	3.00	15,000.00	3.00	15,000.00	2.90	14,500.00	2.70	13,500.00	4.00	20,000.00
44. 4-in. back-pressure valves	3 ea.	9.00	27.00	10.00	30.00	15.00	45.00	10.00	30.00	100.00	300.00
45. Broken stone	300 c.y.	5.50	1,650.00	4.00	1,200.00	5.00	1,500.00	4.00	1,200.00	5.00	1,500.00
46. Vitr. brick sewer lining	130 s.y.	5.50	715.00	4.00	520.00	5.00	650.00	5.00	650.00	6.00	780.00
47. 36x60-in. rein. conc. sewer	2,300 l.f.	13.00	29,900.00	20.00	46,000.00	13.00	29,900.00	20.00	46,000.00	25.00	57,500.00
48. Restore street surf.; sheet asph.	2,300 s.y.	1.10	2,530.00	6.00	13,800.00	2.70	6,210.00	2.50	5,750.00	3.00	6,900.00
49. Restore street surf. within curb lines	275 s.y.	3.00	825.00	4.00	1,100.00	2.60	715.00	2.20	605.00	3.00	825.00
50. Furn., lay 2-in. steel gas pipe	300 l.f.	.70	210.00	1.00	300.00	.80	240.00	1.00	300.00	1.00	300.00
51. Furn., lay 3-in. steel gas pipe	80 l.f.	1.25	100.00	1.50	120.00	1.40	112.00	1.10	88.00	1.50	120.00
52. Furn., lay 8-in. steel gas pipe	800 l.f.	3.80	3,040.00	5.00	4,000.00	4.00	3,200.00	3.50	2,800.00	4.50	3,600.00
53. Remove church, Sheridan Ave.	L.S.	.....	220.00	.....	200.00	.....	500.00	.....	100.00	.....	1.00
54. Remove rectory, Dumont Ave.	L.S.	.....	550.00	.....	500.00	.....	1,000.00	.....	100.00	.....	1.00
55. Remove convent, Old Mill Road	L.S.	.....	220.00	.....	200.00	.....	500.00	.....	100.00	.....	1.00
56. Remove building, Old Mill Road	L.S.	.....	220.00	.....	200.00	.....	500.00	.....	100.00	.....	1.00
57. Remove other structures, fences, trees, etc.	L.S.	.....	4,000.00	.....	15,000.00	.....	7,000.00	.....	1,500.00	.....	3,000.00
58. Salv. bldg. matl., church (cr. to city)	L.S.	.....	1.00	.....	1.00	.....	0.00	.....	1.00	.....	1.00
59. Salv. bldg. matl., rectory (cr. to city)	L.S.	.....	1.00	.....	1.00	.....	0.00	.....	1.00	.....	1.00
60. Salv. bldg. matl., convent (cr. to city)	L.S.	.....	1.00	.....	1.00	.....	0.00	.....	1.00	.....	1.00

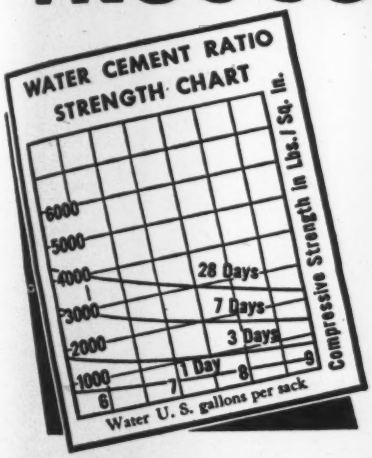
IT IS *SO SIMPLE* TO OBTAIN . . .

Better Concrete

USE LESS WATER

THIS IS NOW POSSIBLE THROUGH THE USE OF—

TRUSCON *Zilicon* WATERPROOFING PASTE



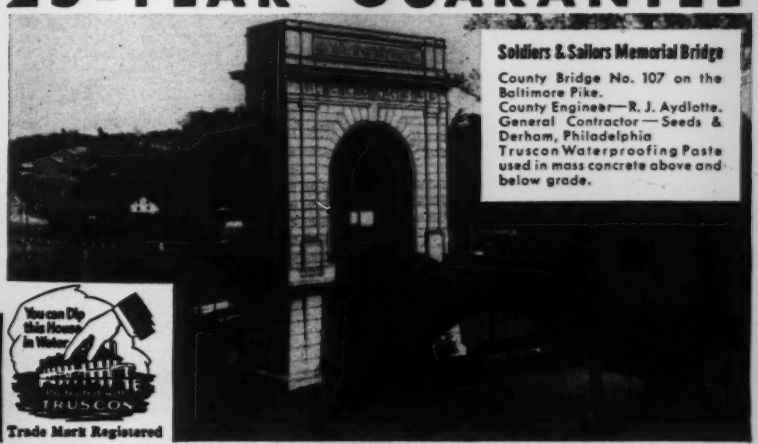
Builders have known right along that if they could only use less water in mixing concrete they would get better concrete. The reason is obvious. Water is incompressible and always occupies the same amount of space. Water being volatile evaporates. Then what's the situation? The space which the water once occupied is left empty in the form of millions of tiny pores. The problem has been: How could less water be used without impairing the workability of the concrete. Science, through the development of a new conception of the physical chemistry of Portland Cement concrete, now gives the answer in TRUSCON ZILICON Waterproofing Paste. This outstanding product is now being offered with a

25-YEAR GUARANTEE

Here are some of the advantages which TRUSCON ZILICON Waterproofing Paste provides:

1. **It allows the use of less water, at the same time improving the workability of the concrete.**
2. **It increases compressive strength.**
3. **It reduces shrinkage.**
4. **It provides marked increase in resistance to freezing and thawing.**
5. **With fixed water cement ratio it gives an increase of over 100 percent of slump.**

Write for Bulletin 494 Giving Full Information



Soldiers & Sailors Memorial Bridge

County Bridge No. 107 on the Baltimore Pike.
County Engineer—R. J. Aydlotte.
General Contractor—Seeds & Derham, Philadelphia
Truscon Waterproofing Paste used in mass concrete above and below grade.

TRUSCON LABORATORIES
DETROIT • MICHIGAN

Trade Mark Registered

Item	Quan.	UNIT PRICES (1) Thos. J. Waters & Sons, Inc., New York, N. Y. Price	Amt.	(2) Cauldwell-Wingate Co., New York, N. Y. Price	Amt.	(3) P. J. Carlin Const. Co., New York, N. Y. Price	Amt.	(4) National Excavation Corp., New York, N. Y. Price	Amt.	(5) Rusciano & Son Corp., Bronx, N. Y. Price	Amt.
61. Salv. bldg. matl., building (cr. to city)	L.S.	.....	$1.00	.....	$1.00	.....	$0.00	.....	$1.00	.....	$1.00
62. Salv. bldg. matl., other struct., fence, etc.	L.S.	.....	1.00	.....	1.00	.....	0.00	.....	1.00	.....	1.00
63. Plastering on conc. masonry	1,050 s.y.	$1.30	1,365.00	$1.30	1,365.00	$1.50	1,575.00	$1.50	1,575.00	$2.00	2,100.00
64. Plastering on metal lath	300 s.y.	2.00	600.00	1.80	540.00	2.00	600.00	1.50	450.00	3.00	900.00
65. Cement base	350 s.f.	.40	140.00	.50	175.00	7.00	2,450.00	.60	210.00	1.00	350.00
66. 1-in. floor finish	85,000 s.f.	.14	11,900.00	.11	9,350.00	.14	11,900.00	.12	10,200.00	.18	15,300.00
67. Cement chimney caps	2 ea.	55.00	110.00	6.00	12.00	40.00	80.00	50.00	100.00	25.00	50.00
68. Cinder fill	1,200 c.y.	1.70	2,040.00	2.20	2,640.00	2.00	2,400.00	1.50	1,800.00	3.00	3,600.00
69. Front brick	2,600 s.f.	.75	1,950.00	.60	1,560.00	.85	2,210.00	2.00	5,200.00	1.00	2,600.00
70. Common brick	17,000 c.f.	1.50	25,500.00	1.20	20,400.00	1.40	23,800.00	.80	13,600.00	1.40	23,800.00
71. Front and common brick	55,000 c.f.	1.70	93,500.00	1.30	71,500.00	1.70	93,500.00	1.20	66,000.00	1.75	96,250.00
72. Terra cotta flue lining	25 l.f.	1.00	25.00	1.00	25.00	2.00	50.00	2.00	50.00	2.00	50.00
73. Terra cotta coping, 8-in. wall	50 l.f.	1.10	55.00	1.00	50.00	.50	25.00	.50	25.00	1.00	50.00
74. Terra cotta coping, 12-in. wall	4,800 l.f.	1.15	5,520.00	1.00	4,800.00	.70	3,360.00	.80	3,840.00	1.20	5,760.00
75. Hollow tile masonry	1,600 c.f.	.60	960.00	1.00	1,600.00	.90	1,440.00	1.00	1,600.00	1.20	1,920.00
76. Metal lath, without furring	15 s.y.	1.00	15.00	1.00	15.00	1.00	15.00	2.00	30.00	2.00	30.00
77. Metal lath, with metal furring	150 s.y.	2.00	300.00	2.00	300.00	2.00	300.00	1.50	225.00	4.00	600.00
78. Metal lath, with wood furring	170 s.y.	1.00	170.00	2.00	340.00	1.80	306.00	1.00	170.00	3.50	595.00
79. Special wire forms	5,100 lb.	.20	1,020.00	.30	1,530.00	.30	1,530.00	.20	1,020.00	.30	1,530.00
80. Wire mesh, under 0.1 sq.in. per ft. slab width	66,000 s.f.	.06	3,960.00	.04	2,640.00	.04	2,640.00	.05	3,300.00	.10	6,600.00
81. Wire mesh, over 0.1 sq.in. per ft. slab width	98,000 s.f.	.06	5,880.00	.05	4,900.00	.04	3,410.00	.07	6,860.00	.10	9,800.00
82. Kalamein windows, double-hung sash, 1¾-in.	45 s.f.	3.00	135.00	4.00	180.00	4.00	180.00	4.00	180.00	10.00	450.00
83. Steel sash, ventilator panels	13,000 s.f.	.90	11,700.00	.90	11,700.00	1.00	13,000.00	.80	10,400.00	2.00	26,000.00
84. Special sash	700 s.f.	1.00	700.00	1.00	700.00	1.20	840.00	1.00	700.00	3.00	2,100.00
85. Double hung sash	1,300 s.f.	3.00	3,900.00	2.80	3,640.00	2.80	3,640.00	2.50	3,250.00	6.00	7,800.00
86. Heavy door checks	45 ea.	6.00	270.00	6.00	270.00	10.00	450.00	6.00	270.00	8.30	373.50
87. Extra heavy door checks	40 ea.	7.00	280.00	7.00	280.00	11.00	440.00	7.00	280.00	10.00	400.00
88. Overhead door stops	25 ea.	4.00	100.00	4.00	100.00	6.00	150.00	4.00	100.00	5.00	125.00
89. Swing door stops	70 ea.	2.00	140.00	2.00	140.00	4.00	280.00	2.00	140.00	2.50	175.00
90. Rubber covered chains	3 set	5.00	15.00	5.00	15.00	7.00	21.00	5.00	15.00	6.00	18.00
91. Heavy mortise dead locks	12 ea.	6.00	72.00	6.00	72.00	10.00	120.00	6.00	72.00	10.00	120.00
92. Push plates, galv. iron	15 ea.	2.00	30.00	2.00	30.00	4.00	60.00	2.00	30.00	4.00	60.00
93. Push plates, bronze	2 ea.	3.00	6.00	2.00	4.00	4.00	8.00	2.00	4.00	5.00	10.00
94. Door pulls, heavy steel	15 ea.	1.00	15.00	1.00	15.00	2.00	30.00	1.00	15.00	2.00	30.00
95. Door pulls, heavy bronze	2 ea.	2.00	4.00	1.00	2.00	2.00	4.00	1.00	2.00	4.00	8.00
96. Kick plates, galv. iron	15 pr.	10.00	150.00	9.00	135.00	16.00	240.00	10.00	150.00	14.00	210.00
97. Kick plates, bronze	2 pr.	10.00	20.00	9.00	18.00	18.00	36.00	10.00	20.00	15.00	30.00
98. Heavy mortise locks	70 ea.	8.00	560.00	8.00	560.00	13.00	910.00	10.00	700.00	13.00	910.00
99. Coat hooks	20 ea.	.50	10.00	.30	6.00	.50	10.00	.50	10.00	1.00	20.00
100. Kalamein shelves	45 s.f.	1.00	45.00	4.00	180.00	2.60	117.00	1.00	45.00	13.00	585.00
101. Metal doors, type GaH	19 ea.	50.00	950.00	50.00	950.00	60.00	1,140.00	50.00	950.00	100.00	1,900.00
102. Kalamein doors, type C	6 pr.	90.00	540.00	85.00	510.00	110.00	660.00	100.00	600.00	150.00	900.00
103. Kalamein doors, type D	10 ea.	55.00	550.00	50.00	500.00	70.00	700.00	75.00	750.00	100.00	1,000.00
104. Kalamein doors, type E	12 ea.	30.00	360.00	40.00	480.00	60.00	720.00	60.00	720.00	100.00	1,200.00
105. Kalamein doors, type ET	1 ea.	50.00	50.00	60.00	60.00	70.00	70.00	100.00	100.00	125.00	125.00
106. Kalamein doors, type F	13 pr.	80.00	1,040.00	85.00	1,105.00	100.00	1,300.00	100.00	1,300.00	150.00	1,950.00
107. Kalamein doors, type M	35 ea.	50.00	1,750.00	55.00	1,925.00	60.00	2,100.00	60.00	2,100.00	100.00	3,500.00
108. Kalamein doors, type MT	1 ea.	60.00	60.00	80.00	80.00	70.00	70.00	80.00	80.00	150.00	150.00
109. Kalamein doors, type Nc	800 s.f.	1.20	960.00	3.20	2,560.00	3.00	2,400.00	1.00	800.00	6.00	4,800.00
110. Kalamein doors, type P	6 ea.	30.00	180.00	20.00	120.00	35.00	210.00	50.00	300.00	100.00	600.00
111. Kalamein doors, type V	1 pr.	90.00	90.00	120.00	120.00	100.00	100.00	100.00	100.00	250.00	250.00
112. Steel doors, type IaS	2 pr.	150.00	300.00	200.00	400.00	180.00	360.00	300.00	600.00	700.00	1,400.00
113. Steel doors, type RS	100 l.f.	40.00	4,000.00	40.00	4,000.00	40.00	4,000.00	40.00	4,000.00	60.00	6,000.00
114. Fire doors, type EU	3 ea.	36.00	108.00	80.00	240.00	70.00	210.00	150.00	450.00	250.00	750.00
115. Fire doors, type HU	1 ea.	60.00	60.00	70.00	70.00	90.00	90.00	80.00	80.00	350.00	350.00
116. Pipe railings	430 l.f.	2.00	860.00	2.50	1,075.00	2.20	946.00	2.00	860.00	3.00	1,290.00
117. Wire mesh swing gates	45 l.f.	15.00	675.00	10.00	450.00	15.00	675.00	10.00	450.00	20.00	900.00
118. Pipe railings for stairs	200 l.f.	2.50	500.00	3.00	600.00	2.60	520.00	2.00	400.00	4.00	800.00
119. Wire mesh partitions	25 l.f.	9.00	225.00	6.00	150.00	11.00	275.00	12.00	300.00	20.00	500.00
120. Hollow metal partitions	20 l.f.	15.00	300.00	6.00	120.00	15.00	300.00	20.00	400.00	50.00	1,000.00
121. Copper ventilators, 1-ft. dia.	2 ea.	25.00	50.00	50.00	100.00	30.00	60.00	30.00	60.00	50.00	100.00
122. Copper ventilators, 2-ft. dia.	2 ea.	55.00	110.00	100.00	200.00	70.00	140.00	75.00	150.00	100.00	200.00
123. Copper ventilators, 10-ft. long	2 ea.	135.00	270.00	200.00	400.00	150.00	300.00	200.00	400.00	250.00	500.00
124. Copper ventilators, 20-ft. long	1 ea.	275.00	275.00	400.00	400.00	280.00	280.00	300.00	300.00	400.00	400.00
125. Louvers, with movable vanes	1 ea.	25.00	25.00	10.00	10.00	30.00	30.00	60.00	60.00	50.00	50.00
126. C.i. grilles with frames	5 ea.	22.00	110.00	10.00	50.00	25.00	125.00	10.00	50.00	15.00	75.00
127. Cast iron saddles	120 l.f.	2.20	264.00	2.20	264.00	2.50	300.00	3.00	360.00	5.00	600.00
128. Steel saddles	300 l.f.	2.00	600.00	2.00	600.00	2.50	750.00	2.50	750.00	3.00	900.00
129. Steel ladders with rungs	410 l.f.	1.70	697.00	2.20	902.00	2.00	820.00	1.50	615.00	5.00	2,050.00
130. Steel plate trap doors	40 s.f.	3.60	144.00	4.00	160.00	4.00	160.00	10.00	400.00	12.00	480.00
131. Pipe handrails	220 l.f.	1.15	253.00	1.20	264.00	1.20	264.00	2.00	440.00	2.50	550.00
132. Rough plumbing, inspect. shed	L.S.	.....	6,250.00	.....	15,000.00	.....	10,000.00	.....	10,000.00	.....	20,000.00
133. Rough plumbing, signal tower	L.S.	.....	1,350.00	.....	4,000.00	.....	2,500.00	.....	4,000.00	.....	6,500.00
134. Rough plumbing, sub-sta.; garage	L.S.	.....	1,500.00	.....	5,000.00	.....	3,000.00	.....	4,000.00	.....	7,000.00
135. Rough plumbing, maint. bldg.	L.S.	.....	2,300.00	.....	5,000.00	.....	4,000.00	.....	3,000.00	.....	7,000.00
136. Rough plumbing, gate house	L.S.	.....	460.00	.....	1,500.00	.....	1,000.00	.....	2,000.00	.....	1,500.00
137. Rough plumbing, oil house	L.S.	.....	500.00	.....	1,400.00	.....	1,000.00	.....	1,000.00	.....	1,000.00
138. Spec. seats, wat. closet bowls	24 ea.	5.50	132.00	6.00	144.00	7.00	168.00	7.00	168.00	10.00	240.00
139. Furn. back outlet w.c. bowls	18 ea.	33.00	594.00	40.00	720.00	40.00	720.00	30.00	540.00	150.00	2,700.00
140. Furn. bottom outlet w.c. bowls	6 ea.	24.00	144.00	30.00	180.00	30.00	180.00	22.00	132.00	150.00	900.00
141. Furn. urinals, stall type	21 ea.	48.00	1,008.00	50.00	1,050.00	60.00	1,260.00	50.00	1,050.00	200.00	4,200.00
142. Furn. lavatories, bottom outlet	4 ea.	35.00	140.00	40.00	160.00	40.00	160.00	30.00	120.00	150.00	600.00
143. Furn. slop sinks, porc. enam. iron	5 ea.	30.00	150.00	30.00	150.00	40.00	200.00	40.00	200.00	125.00	625.00
144. Furn. wash sinks	4 ea.	60.00	240.00	60.00	240.00	75.00	300.00	100.00	400.00	125.00	500.00
145. Furn. conc. wash fountains	10 ea.	250.00	2,500.00	300.00	3,000.00	270.00	2,700.00	100.00	1,000.00	300.00	3,000.00
146. Furn. drinking fount., pedestal type	2 ea.	33.00	66.00	40.00	80.00	40.00	80.00	30.00	60.00	300.00	600.00
147. Furn. drinking fount., wall type	8 ea.	22.00	176.00	30.00	240.00	30.00	240.00	30.00	240.00	250.00	2,000.00
148. Furn. thermo-control valves	3 ea.	105.00	315.00	100.00	300.00	140.00	420.00	30.00	90.00	100.00	300.00
149. Furn. shower heads	10 ea.	3.00	30.00	3.00	30.00	5.00	50.00	30.00	300.00	50.00	500.00
150. Furn. pedal flush valve controls	37 ea.	17.00	629.00	16.00	592.00	20.00	740.00	30.00	1,110.00	100.00	3,700.00
151. Furn. lavatories, center outlet	1 ea.	17.00	17.00	16.00	16.00	20.00	20.00	30.00	30.00	150.00	150.00
152. Furn. floor drains, not types A or B	12 ea.	25.00	300.00	30.00	360.00	25.00	300.00	15.00	180.00	40.00	480.00
153. Furn. floor drains, type A	3 ea.	25.00	75.00	30.00	90.00	25.00	75.00	30.00	90.00	50.00	150.00
154. Furn. floor drains, type B	11 ea.	25.00	275.00	30.00	330.00	25.00	275.00	30.00	330.00	50.00	550.00
155. Install back outlet water closet bowls	18 ea.	20.00	360.00	16.00	288.00	20.00	360.00	20.00	360.00	50.00	900.00
156. Install bottom outlet water closet bowls	6 ea.	20.00	120.00	16.00	96.00	20.00	120.00	20.00	120.00	50.00	300.00
157. Install urinals, stall type	21 ea.	20.00	420.00	20.00	420.00	20.00	420.00	20.00	420.00	50.00	1,050.00
158. Install lavatories, bottom outlet	4 ea.	20.00	80.00	20.00	80.00	20.00	80.00	20.00	80.00	50.00	200.00
159. Install slop sinks, porc. enam. iron	5 ea.	20.00	100.00	20.00	100.00	20.00	100.00	20.00	100.00	35.00	175.00
160. Install wash sinks	4 ea.	25.00	100.00	24.00	96.00	25.00	100.00	30.00	120.00	35.00	140.00

LAMSON BOLTS
FOR *Steel* CONSTRUCTION

• Lamson & Sessions can meet your requirements in bolt and nut products for steel construction from warehouse stocks. In addition to machine bolts, fitting-up bolts, cotters, wire rope clips, nuts and other standard products in a full range of sizes, Lamson offers at least two specialties that dovetail with the present national emergency program of building soundly and economically, and in the shortest possible time. • Lamson Lock Nuts provide security where vibration is severe or where sustained or sudden shock is encountered. These nuts may be used over again and again. • Dardelet Rivet bolts produce steel joints more secure than riveted joints, and with greater speed and lower cost of assembly. No compressed air, forge or skilled labor is required with the use of Dardelet Rivet bolts—just a maul and a wrench is needed. • Structures in which these two products are used can easily be altered or dismantled. Particulars and samples on request.

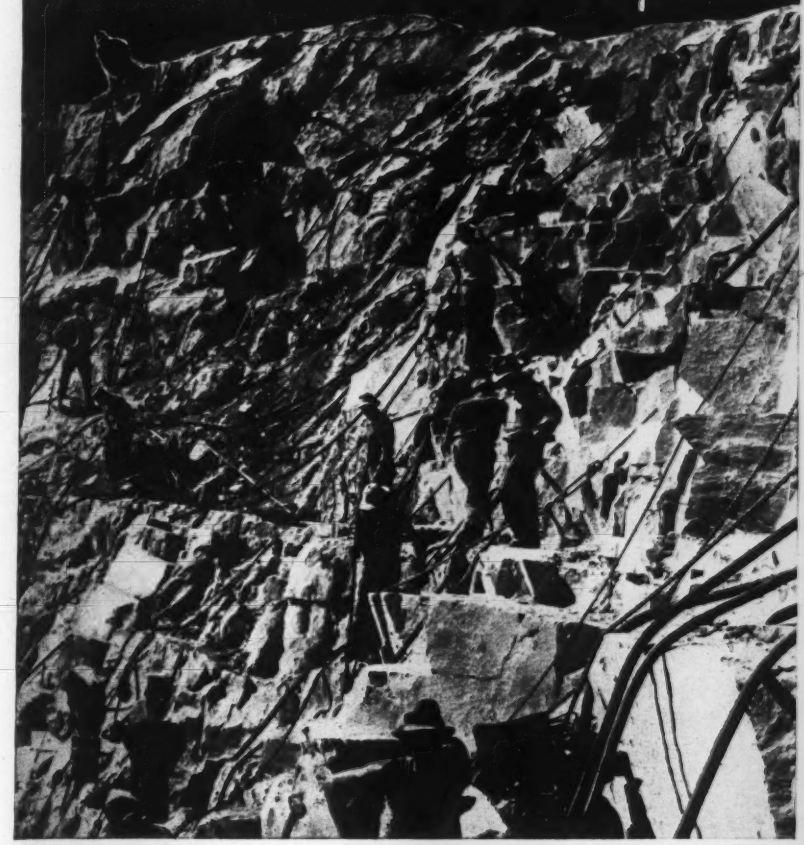
THE LAMSON & SESSIONS COMPANY, Cleveland, Ohio
Plants at Cleveland and Kent, Ohio; Chicago and Birmingham

LAMSON & SESSIONS

BOLTS • • NUTS • • COTTERS • • CAP SCREWS • • SPECIALS

Item	Quan.	UNIT PRICES (1) Thos. J. Waters & Sons, Inc., New York, N. Y. Price	Amt.	(2) Cauldwell-Wingate Co., New York, N. Y. Price	Amt.	(3) P. J. Carlin Const. Co., New York, N. Y. Price	Amt.	(4) National Excavation Corp., New York, N. Y. Price	Amt.	(5) Rusciano & Son Corp., Bronx, N. Y. Price	Amt.
161. Install conc. wash fountains	10 ea.	$50.00	$500.00	$50.00	$500.00	$55.00	$550.00	$30.00	$300.00	$60.00	$600.00
162. Install drinking fount., pedestal type	2 ea.	20.00	40.00	20.00	40.00	20.00	40.00	30.00	60.00	45.00	90.00
163. Install drinking fount., wall type	8 ea.	20.00	160.00	20.00	160.00	20.00	160.00	30.00	240.00	40.00	320.00
164. Install thermo-control valves	3 ea.	20.00	60.00	20.00	60.00	20.00	60.00	30.00	90.00	10.00	30.00
165. Install shower heads	10 ea.	35.00	350.00	40.00	400.00	40.00	400.00	30.00	300.00	20.00	200.00
166. Install pedal flush valve controls	37 ea.	20.00	740.00	20.00	740.00	20.00	740.00	30.00	1,110.00	30.00	1,110.00
167. Install lavatories, center outlet	1 ea.	20.00	20.00	20.00	20.00	20.00	20.00	30.00	30.00	50.00	50.00
168. Install floor drains, not types A or B	12 ea.	8.00	96.00	8.00	96.00	10.00	120.00	10.00	120.00	20.00	240.00
169. Install floor drains, type A	3 ea.	8.00	24.00	8.00	24.00	10.00	30.00	10.00	30.00	20.00	60.00
170. Install floor drains, type B	11 ea.	8.00	88.00	8.00	88.00	10.00	110.00	10.00	110.00	20.00	220.00
171. 3-in. copper-brg. steel pipe, cem.-lined	300 l.f.	1.10	330.00	1.00	300.00	1.20	360.00	1.00	300.00	2.50	750.00
172. 4-in. copper-brg. steel pipe, cem.-lined	700 l.f.	1.50	1,050.00	1.50	1,050.00	1.50	1,050.00	1.20	840.00	3.00	2,100.00
173. 5-in. copper-brg. steel pipe, cem.-lined	450 l.f.	2.00	900.00	2.00	900.00	2.20	990.00	1.70	765.00	3.50	1,575.00
174. 3-in. black steel pipe, cem.-lined	300 l.f.	1.00	300.00	1.00	300.00	1.10	330.00	1.00	300.00	2.50	750.00
175. 4-in. black steel pipe, cem.-lined	350 l.f.	1.50	525.00	1.30	455.00	1.40	490.00	1.20	420.00	3.00	1,050.00
176. 5-in. black steel pipe, cem.-lined	200 l.f.	2.00	400.00	2.00	400.00	1.90	380.00	1.70	340.00	3.50	700.00
177. 6-in. black steel pipe, cem.-lined	375 l.f.	2.20	825.00	2.00	750.00	2.00	750.00	2.00	750.00	4.00	1,500.00
178. 8-in. black steel pipe, cem.-lined	100 l.f.	3.00	300.00	3.00	300.00	3.20	320.00	2.70	270.00	5.00	500.00
179. Str. slate for wall wainscoating	600 s.f.	1.30	780.00	1.00	600.00	1.70	1,020.00	1.50	900.00	2.00	1,200.00
180. Str. slate for pipe chamber partition	850 s.f.	1.30	1,105.00	1.00	850.00	1.70	1,445.00	1.50	1,275.00	2.00	1,700.00
181. Str. slate for shelves	240 s.f.	1.00	240.00	1.00	240.00	1.50	360.00	1.00	240.00	2.00	480.00
182. Str. slate for stall partitions	930 s.f.	1.60	1,488.00	1.50	1,395.00	1.80	1,674.00	1.50	1,395.00	2.00	1,860.00
183. Str. slate for curved corners, angles	90 l.f.	2.50	225.00	2.00	180.00	2.20	198.00	2.00	180.00	3.00	270.00
184. Str. slate for seats	5 ea.	14.00	70.00	15.00	75.00	5.00	25.00	15.00	75.00	10.00	50.00
185. Str. slate for stiles and caps	160 s.f.	1.80	288.00	2.00	320.00	2.20	352.00	2.00	320.00	3.00	480.00
186. Register faces and fr., no louvres	6 ea.	12.00	72.00	10.00	60.00	20.00	120.00	10.00	60.00	15.00	90.00
187. ¾-in. elec. conduits and fittings	800 l.f.	.35	280.00	.30	240.00	.32	256.00	.25	200.00	.50	400.00
188. 1-in. elec. conduits and fittings	7,500 l.f.	.45	3,375.00	.35	2,625.00	.35	2,625.00	.40	3,000.00	.60	4,500.00
189. 1½-in. elec. conduits and fittings	800 l.f.	.70	560.00	.60	480.00	.60	480.00	.60	480.00	.90	720.00
190. 2-in. elec. conduits and fittings	1,500 l.f.	.90	1,350.00	.60	900.00	.70	1,050.00	.70	1,050.00	1.20	1,800.00
191. 2½-in. elec. conduits and fittings	1,000 l.f.	1.20	1,200.00	1.00	1,000.00	.90	900.00	1.00	1,000.00	1.80	1,800.00
192. 3-in. elec. conduits and fittings	1,200 l.f.	1.50	1,800.00	1.00	1,200.00	1.20	1,440.00	1.20	1,440.00	2.40	2,880.00
193. 3½-in. elec. conduits and fittings	4,300 l.f.	1.80	7,740.00	1.50	6,450.00	1.50	6,450.00	1.50	6,450.00	3.00	12,900.00
194. 4-in. elec. conduits and fittings	1,000 l.f.	2.20	2,200.00	1.50	1,500.00	1.90	1,900.00	2.00	2,000.00	3.30	3,300.00
195. 4x4x2-in. c.i. outlet boxes	225 ea.	2.20	495.00	2.00	450.00	2.40	540.00	2.00	450.00	3.00	675.00
196. 4x4x3-in. c.i. outlet boxes	425 ea.	2.00	850.00	2.00	850.00	2.60	1,105.00	2.00	850.00	3.20	1,360.00
197. 18x12x6-in. c.i. pull boxes, incl. cov.	2 ea.	15.00	30.00	30.00	60.00	40.00	80.00	20.00	40.00	50.00	100.00
198. 6x6x4-in. c.i. pull boxes, incl. cov.	15 ea.	4.00	60.00	5.00	75.00	7.00	105.00	5.00	75.00	10.00	150.00
199. 12x6x4-in. c.i. pull boxes, incl. cov.	10 ea.	8.00	80.00	10.00	100.00	11.00	110.00	10.00	100.00	15.00	150.00
200. 8x8x4-in. c.i. pull boxes, incl. cov.	1 ea.	7.00	7.00	9.00	9.00	12.00	12.00	10.00	10.00	16.00	16.00
201. 8x6x4-in. c.i. pull boxes, incl. cov.	10 ea.	4.00	40.00	7.00	70.00	8.00	80.00	10.00	100.00	12.00	120.00
202. 8x4x3-in. c.i. pull boxes, incl. cov.	2 ea.	5.00	10.00	7.00	14.00	8.00	16.00	10.00	20.00	12.00	24.00
203. 18x16x6-in. c.i. pull boxes, incl. cov.	2 ea.	18.00	36.00	40.00	80.00	60.00	120.00	30.00	60.00	75.00	150.00
204. 18x12x6-in. c.i. pull box, st. trim and hinged covers	2 ea.	15.00	30.00	60.00	120.00	75.00	150.00	30.00	60.00	175.00	350.00
205. 4-gang switch box, switch plate covers	1 ea.	10.00	10.00	20.00	20.00	30.00	30.00	10.00	10.00	125.00	125.00
206. 24x16x8-in. c.i. pull box, incl. cover	2 ea.	30.00	60.00	120.00	240.00	160.00	320.00	50.00	100.00	115.00	230.00
207. St. circ. breaker control box; ebony door, lining	4 ea.	150.00	600.00	170.00	680.00	200.00	800.00	200.00	800.00	175.00	700.00
208. 24x30x6-in. steel c.b. box; no trim or door	3 ea.	50.00	150.00	50.00	150.00	70.00	210.00	100.00	300.00	50.00	150.00
209. 2-in. thermal insulation	1,250 s.f.	.10	125.00	.30	375.00	.40	500.00	.15	187.50	.30	375.00
210. Topsoil	4,000 s.y.	.40	1,600.00	1.20	4,800.00	.50	2,000.00	.70	2,800.00	1.50	6,000.00
211. Sheet copper, formed as indicated	40 s.f.	.60	24.00	1.00	40.00	1.50	60.00	.50	20.00	2.00	80.00
212. Sh. copper, leader heads, 3-in. leaders	25 ea.	10.00	250.00	5.00	125.00	7.00	175.00	10.00	250.00	15.00	375.00
213. Copper leader inlets	50 ea.	5.00	250.00	5.00	250.00	7.00	350.00	5.00	250.00	15.00	750.00
214. Copper 3-in. leaders	200 l.f.	.60	120.00	.30	60.00	1.00	200.00	1.00	200.00	1.20	240.00
215. Cut stone work, gate house	L.S.	.....	300.00	.....	600.00	.....	1,000.00	.....	500.00	.....	3,000.00
216. Cut stone work, sub-station; garage	L.S.	.....	100.00	.....	700.00	.....	300.00	.....	500.00	.....	750.00
217. Copper covered scuttles	2 ea.	50.00	100.00	50.00	100.00	40.00	80.00	50.00	100.00	100.00	200.00
218. Wood platforms for floodlight towers	90 s.f.	2.00	180.00	3.00	270.00	1.00	90.00	1.00	90.00	2.00	180.00
219. Pressed steel stairs	250 l.f.	3.50	875.00	2.50	625.00	4.50	1,125.00	10.00	2,500.00	5.00	1,250.00
220. St. stairs with grating treads	150 l.f.	4.00	600.00	2.00	300.00	4.70	705.00	2.00	300.00	5.00	750.00
221. St. stairway landings; grating treads	20 s.f.	4.00	80.00	1.00	20.00	4.70	94.00	2.00	40.00	5.00	100.00
222. Corrugated asbestos roof	1,000 s.f.	.50	500.00	1.00	1,000.00	.65	650.00	.50	500.00	1.00	1,000.00
223. Checkered steel plate covers	300 s.f.	2.50	750.00	2.00	600.00	2.80	840.00	1.50	450.00	3.00	900.00
224. 5-ply waterproofing	8,000 s.y.	.80	6,400.00	.80	6,400.00	.95	7,600.00	.70	5,600.00	1.50	12,000.00
225. 1-in. fibre board insulation; roofs	9,000 s.f.	.10	900.00	.10	900.00	.10	900.00	.08	720.00	.20	1,800.00
226. Slag or gravel for roofs	7,500 s.y.	.40	3,000.00	.30	2,250.00	.33	2,475.00	.30	2,250.00	.50	3,750.00
227. Felt flashing	8,000 l.f.	.30	2,400.00	.20	1,600.00	.27	2,160.00	.50	4,000.00	1.50	12,000.00
228. 6-in. post indicator valves	2 ea.	70.00	140.00	60.00	120.00	90.00	180.00	100.00	200.00	200.00	400.00
229. 8-in. post indicator valves	9 ea.	50.00	450.00	50.00	450.00	75.00	675.00	100.00	900.00	300.00	2,700.00
230. 2-in. gate valves	1 ea.	4.00	4.00	4.00	4.00	10.00	10.00	10.00	10.00	50.00	50.00
231. 4-in. gate valves	1 ea.	16.00	16.00	15.00	15.00	25.00	25.00	30.00	30.00	150.00	150.00
232. 4-in. check valve	2 ea.	13.00	26.00	12.00	24.00	25.00	50.00	30.00	60.00	150.00	300.00
233. 6-in. check valve	4 ea.	25.00	100.00	25.00	100.00	40.00	160.00	40.00	160.00	200.00	800.00
234. Siamese connections	4 ea.	8.00	32.00	7.00	28.00	75.00	300.00	10.00	40.00	300.00	1,200.00
235. 2½-in. hose valves	7 ea.	7.00	49.00	6.00	42.00	10.00	70.00	10.00	70.00	80.00	560.00
236. 4-in. gate valves, incl. boxes	7 ea.	16.00	112.00	15.00	105.00	30.00	210.00	30.00	210.00	150.00	1,050.00
237. 6-in. gate valves, incl. boxes	22 ea.	30.00	690.00	30.00	690.00	45.00	1,035.00	50.00	1,150.00	250.00	5,750.00
238. Remove, reset hydrants, incl. gate valves	7 ea.	60.00	420.00	60.00	420.00	160.00	1,120.00	100.00	700.00	80.00	560.00
239. Furn. and inst. hydrants	14 ea.	65.00	910.00	60.00	840.00	160.00	2,240.00	125.00	1,750.00	100.00	1,400.00
240. 1-in. industrial disc meters	1 ea.	25.00	25.00	25.00	25.00	40.00	40.00	40.00	40.00	60.00	60.00
241. 4-in. industrial disc meters	1 ea.	250.00	250.00	250.00	250.00	300.00	300.00	300.00	300.00	150.00	150.00
242. 6-in. long-throat water meters; fire line	2 ea.	550.00	1,100.00	500.00	1,000.00	600.00	1,200.00	1,000.00	2,000.00	200.00	400.00
243. 4-in. O.S. & Y. valves	1 ea.	17.00	17.00	17.00	17.00	30.00	30.00	20.00	20.00	150.00	150.00
244. 6-in. O.S. & Y. valves	4 ea.	40.00	160.00	40.00	160.00	60.00	240.00	40.00	160.00	200.00	800.00
245. 3-in. ferruls of pipe, fitt., in masonry walls	1 ea.	1.00	1.00	1.00	1.00	4.00	4.00	1.00	1.00	50.00	50.00
246. 6-in. ferruls of pipe, fitt., in masonry walls	2 ea.	2.00	4.00	1.50	3.00	5.00	10.00	2.00	4.00	80.00	160.00
247. 8-in. ferruls of pipe, fitt., in masonry walls	1 ea.	2.00	2.00	2.00	2.00	6.00	6.00	3.00	3.00	100.00	100.00
248. 10-in. ferruls of pipe, fitt., in masonry walls	2 ea.	2.00	4.00	2.00	4.00	8.00	16.00	4.00	8.00	125.00	250.00
249. 12-in. ferruls of pipe, fitt., in masonry walls	1 ea.	3.00	3.00	3.00	3.00	10.00	10.00	5.00	5.00	150.00	150.00
250. 14-in. ferruls of pipe, fitt., in masonry walls	2 ea.	6.00	12.00	6.00	12.00	12.00	24.00	6.00	12.00	180.00	360.00
251. Paint masonry and plaster surfaces	200,000 s.f.	.05	10,000.00	.04	8,000.00	.05	10,000.00	.06	12,000.00	.12	24,000.00
252. Paint exposed br. and conc. surf.; damp-pr.	7,000 s.f.	.08	560.00	.07	490.00	.10	700.00	.10	700.00	.12	840.00
253. Skylights, inspection shed roof	20,000 s.f.	2.00	40,000.00	2.00	40,000.00	2.50	50,000.00	2.00	40,000.00	2.50	50,000.00
254. Skylights, maintenance bldg. roof	25 s.f.	3.00	75.00	4.00	100.00	6.00	150.00	3.00	75.00	5.00	125.00
255. Rein. conc. fence	4,500 l.f.	7.00	31,500.00	10.00	45,000.00	6.00	27,000.00	16.00	77,000.00	12.00	54,000.00
256. Tracks in inspection shed	2,750 l.f.	1.50	4,125.00	2.20	6,050.00	3.00	8,250.00	1.90	5,225.00	3.00	8,250.00
257. Other tracks	40 l.f.	1.50	60.00	2.20	88.00	4.00	160.00	2.00	80.00	5.00	200.00
258. C.i. pedestal rail supports	1,600 ea.	5.00	8,000.00	5.50	8,800.00	7.00	11,200.00	5.00	8,000.00	10.00	16,000.00
259. Collision bumpers	4 ea.	1,000.00	4,000.00	1,500.00	6,000.00	800.00	3,200.00	1,500.00	6,000.00	1,000.00	4,000.00
260. Timber stringers	5,400 l.f.	2.00	10,800.00	2.00	10,800.00	2.00	10,800.00	2.00	10,800.00	2.00	10,800.00
261. Copper covered canopies	150 l.f.	5.00	750.00	4.00	600.00	6.00	900.00	10.00	1,500.00	20.00	3,000.00
262. Walkways for bridges	200 s.f.	1.00	200.00	1.00	200.00	.50	100.00	10.00	2,000.00	1.00	200.00
263. Flag poles	2 ea.	300.00	600.00	250.00	500.00	500.00	1,000.00	250.00	500.00	300.00	600.00

Another Manhattan Development-



Condor Homo-Flex HOSE

EASY TO HANDLE
LIGHT . . . . .
STRONG . . . .
KINKLESS . . .

HERE is the most outstanding development in hose construction in years —unusual strength and long life with extreme lightness; flexible as a rope, yet tough and kinkless.

The radical departures in design and construction are the outgrowth of engineering research into the causes of hose failure and of requirements to offset these.

Results of the first service tests were so far beyond expectancy that Condor Homo-Flex was introduced in a limited way under conditions chosen for severity of service and watched closely during a long probationary period. This fully confirmed early tests.

Condor Homo-Flex is made in several types for air, water, high-pressure spray, air-oil, oil spray, and high-pressure orchard spray service.

It's too much of a story for this space, so send for important Bulletin No. 6879.

9 Homo-Flex ADVANTAGES

1 Extreme flexibility—easy to handle
2 Light in weight
3 Practically inseparable cover and plies—balanced homogeneous construction
4 Withstands high pressures and surges with wide margins of safety
5 Uniform inside and outside diameters
6 Less elongation and expansion
7 Less fatigue to operator
8 More production
9 Lower ultimate cost

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Birmingham Chicago Cleveland New Orleans New York Boston
Minneapolis Detroit Pittsburgh Philadelphia St. Louis San Francisco

Cost Summary of Selected U.S.H.A.–Aided Housing Projects

Location and Name of Project	No. of Units	No. of Rooms	Height (in stories)	Estimated Over-all Cost Per Dwelling Unit						Estimated New Housing Cost
							Dwelling Facilities			
				Total [1]	Land [2]	Non-dwelling Facilities [3]	Total [4]	Net Const. Cost [5]	Equipment, Fees, Overhead [6]	
Akron, Ohio, Edgewood Homes	274	1,153	2&3	$4,649	$243	$729	$3,677	$2,909	$768	$1,273,713
Atlanta, Ga., Henry Grady Homes	616	2,468	2	3,779	472	565	2,742	2,164	578	2,327,738
Baltimore, Md., Clarence Perkins Homes	688	2,898	2&3	5,175	842	781	3,552	2,950	602	3,560,161
Beverly, N. J., Delacove Homes	71	319½	2	4,569	115	514	3,940	3,248	692	324,421
Biloxi, Miss., Bayview Homes	96	408	2	3,501	43	533	2,925	2,287	638	336,120
Birmingham, Ala., Central City	913	3,475½	2&3	4,114	904	297	2,913	2,375	538	3,755,642
Bremerton, Wash., Westpark *	600	2,330	1	3,672	99	1,040	2,533	2,185	348	2,203,000
Bridgeport, Conn., Marina Village	516	2,357	3&4	4,643	523	578	3,542	2,920	622	2,395,762
Brownsville, Tex., Bougainvillea	49	210½	1	3,796	168	781	2,847	2,157	690	186,005
Champaign County, Ill., Gen. Wm. Mitchell Homes *	100	444	1&2	4,746	57	1,149	3,540	2,787	753	474,585
Charleston, S. C., Ben Tillman Homes *	400	1,756	1&2	3,551	69	507	2,975	2,524	451	1,420,362
Chester, Pa., Lamokin Village	350	1,477	2&3	4,088	259	561	3,268	2,629	639	1,430,822
Cincinnati, Ohio, English Woods	750	3,017	2	4,978	120	1,166	3,692	3,006	686	3,733,745
Columbus, Ga., Newton D. Baker Village *	612	2,608	1&2	3,378	53	598	2,727	2,272	455	2,067,449
Columbus, Ohio, West Rich Street	252	912	2,3&4	3,998	154	606	3,238	2,566	672	1,007,500
Corpus Christi, Tex., La Armada *	250	1,096	1&2	3,880	95	642	3,143	2,603	540	969,941
Danville, Ill., Fair Oaks Park	176	773	2	4,471	127	573	3,771	2,972	799	786,917
Darlington Co., S. C., (rural)	200	1,050	1	1,569	81	169	1,319	1,119	200	420,000
Decatur, Ga., Allen Wilson Terrace	200	764	2	3,409	120	505	2,784	2,210	574	681,846
Denver Colo., Lincoln Park Homes	346	1,487	2&3	4,317	290	475	3,552	2,831	721	1,493,636
Detroit, Mich., S. James Herman Gardens	2,150	8,408	2&3	5,167	178	984	4,005	3,270	735	11,108,216
Fall River Mass., Harbor Terrace	223	966	3	4,549	381	447	3,721	2,976	745	1,014,413
Fort Wayne, Ind., Westfield Village	120	549	1	2,779	26	455	2,298	1,830	468	333,445
Frederick, Md., Lincoln Apts	50	207	2	3,871	209	597	3,065	2,385	680	193,565
Hammond, Ind., Columbia Center	400	1,818	1&2	4,397	257	928	3,212	2,573	639	1,758,907
Hamtramck, Mich., Col. Hamtramck Homes	300	1,344	2	4,816	480	653	3,683	2,962	721	1,444,749
Hartford, Conn., Defense Homes *	1,000	4,450	1&2	4,386	94	852	3,440	2,903	537	4,385,880
Helena, Mont., Samuel V. Stewart Homes	72	298	1&2	4,530	88	863	3,579	2,707	872	326,127
Jacksonville, Fla., Jefferson-Madison Homes	708	3,044	2	3,218	262	444	2,512	2,006	506	2,278,574
Kinston, N. C., Simon Bright Homes	152	638	2	3,486	96	466	2,924	2,351	573	529,922
Lee County, Miss. (rural)	300	1,650	Det	2,059	76	301	1,682	1,506	176	617,700
Lexington, Ky., Charlotte Courts	206	863	1&2	3,995	168	604	3,223	2,517	706	822,873
Lonoke County, Ark. (rural)	300	1,650	1	1,802	64	134	1,604	1,421	183	540,750
Martinsburg, W. Va., Adam Stephen Homes	48	204	2	3,827	61	435	3,331	2,684	647	183,739
Memphis, Tenn., Le Moyne Gardens	500	2,144	2	3,707	170	576	2,961	2,430	531	1,853,595
Nashville, Tenn., Boscobel Heights	36	168	2	4,296	186	442	3,668	2,963	705	154,667
Newark, N. J., John W. Hyatt Court	402	1,746	3	4,732	288	565	3,879	3,259	620	1,902,083
New Bedford, Mass., Presidential Heights	200	919	2	4,528	65	707	3,756	2,960	796	905,699
New Bern, N. C., Craven Court	253	981½	1&2	3,841	396	555	2,890	2,373	517	971,659
New Orleans, La., St. Bernard	744	3,214	2&3	4,881	217	997	3,667	2,839	828	3,631,366
Newport, R. I., Park Holm *	262	1,205	1&2	4,462	102	815	3,545	2,943	602	1,168,942
Newport News, Va., Orcutt Homes *	148	606	2	4,020	208	457	3,355	2,884	471	594,898
New York, N. Y., East River Houses	1,170	4,901	6,10&11	4,568	910	487	3,171	2,597	574	5,344,931
Kingsborough Houses	1,166	4,746	6	3,902	455	195	3,252	2,652	600	4,549,194
No. Little Rock, Ark., Silver City Courts	148	674	2	3,896	190	591	3,115	2,494	621	576,631
Oakland, Calif., Peralta Villa	396	1,636	2	4,159	660	459	3,040	2,469	571	1,646,966
Pawtucket, R. I., Prospect Heights	310	1,425	2	4,656	217	563	3,876	3,153	723	1,443,382
Pensacola, Fla., Moreno Court *	200	784	1	3,231	85	475	2,671	2,176	495	646,211
Philadelphia, Pa., Richard Allen Homes	1,324	5,856	3&4	4,843	646	475	3,722	3,074	648	6,411,922
Phoenix, Ariz., Marcos de Niza	224	924	1	2,919	171	521	2,227	1,716	511	653,843
Portsmouth, Va., Dale Homes *	300	1,333	1&2	3,696	60	555	3,081	2,630	451	1,108,731
Rock Island, Ill., Arsenal Courts *	305	1,324	1&2	4,393	172	714	3,507	2,894	613	1,339,819
St. Louis, Mo., Carr Square Village	658	2,820	2&3	4,809	240	676	3,893	3,195	698	3,164,065
San Antonio, Tex., Victoria Courts	796	3,774	2	3,221	220	435	2,566	2,045	521	2,564,061
Seattle, Wash., Sand Point *	150	514½	1&2	3,735	254	642	2,839	2,080	759	620,120
Selma, Ala., Nathan B. Forrest Homes *	200	830	1	3,455	46	731	2,678	2,124	554	691,063
Springfield, Ill., John Hay Homes	599	2,559	2	4,028	132	390	3,506	2,776	730	2,412,648
Stamford, Conn., Southfield Village	250	1,139	2	4,783	165	857	3,761	3,043	718	1,195,832
Tampa, Fla., Ponce de Leon Courts	320	1,412	1&2	3,206	198	407	2,601	2,101	500	1,025,859
Washington, D. C., Carrollsburg Dwellings	314	1,293	2&3	5,116	404	400	4,312	3,689	623	1,606,310

Table Footnotes:

* Defense housing projects.

[1] Consists of all costs of project except cost of slum buildings to be torn down, cost of land for future development, and local housing authority's administrative, carrying and contingent expenses applicable to these excepted items. The following items involved in some projects are not included since they are not properly chargeable to cost of new housing: (a) The cost of slum buildings to be torn down on the project site which represents an expenditure for slum clearance; and (b) the cost of land for future development which represents an expenditure for land which will later be used for additional housing. The exclusion of these two items makes possible fair comparisons between costs in USHA-aided projects and costs of private housing when land costs are included.

[2] Consists of cost of land to be purchased and value of land to be donated and to be used for present development. Includes also expenses of acquiring such land and the local housing authority's administrative, carrying, and contingent expenses applicable to such land. It does not include the cost of demolition or land for future development.

[3] Consists of the construction cost of site improvements and non-dwelling buildings, non-dwelling spaces and equipment, preoccupancy charges, and the local housing authority's architectural, administrative, carrying, and contingent applicable expenses.

[4] "Dwelling facilities cost" is the total of the construction cost of dwellings (referred to in footnote 5 as "Net construction cost"), dwelling equipment (ranges, refrigerators, screens, etc.), and local authority's architectural, administrative, carrying, and contingent expenses. Amount shown includes allowances for changes and extras.

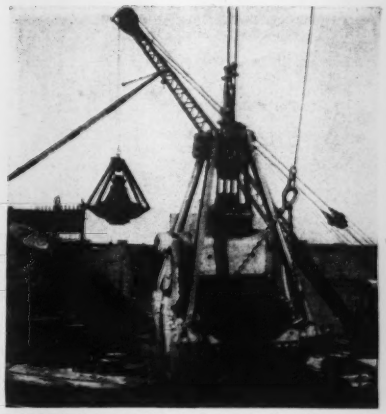
[5] "Net construction cost" is the construction cost of dwellings — i.e., structural, plumbing, heating, and electrical costs. Amounts shown do not include any allowances for changes and extras. Items contained in "Net construction cost" most nearly comprise items contained in residential construction costs as complied by the Bureau of Labor Statistics on basis of building-permit data.

[6] "Equipment, architects' fees, and overhead" consists of the cost of dwelling equipment (ranges, refrigerators, screens, etc.) and local authority's architectural, administrative, carrying, and contingent expenses applicable to dwelling construction and dwelling equipment.

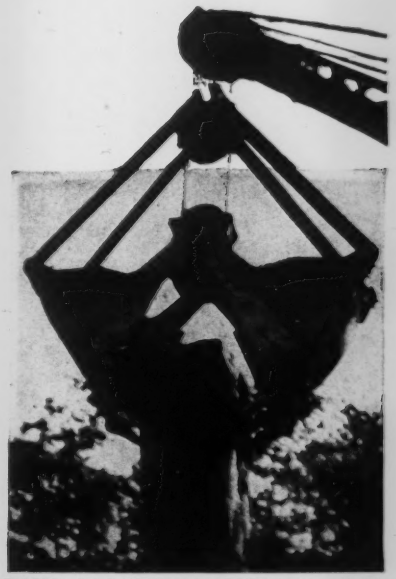
A BUYING GUIDE

TO EXCAVATING AND HANDLING EQUIPMENT THAT WILL PAY PROFITS ON ITS PURCHASE

HAISS MODEL 135 LOADER—5 to 8 yds. per min. capacity. Capacity equal to a 1½ yd. shovel at something like half the cost. Self-feeding via Haiss-patented revolving feeding propellers. Cleans up without hand shoveling. Crowds under power at 5 ft. per min. via worm-drive. Leaves a smooth floor. Gasoline motor. Diesel or electric motor drive. One man operation, 24,000 lbs. net weight.



HAISS Hi-Power Buckets for Heavy Excavation. Capacities up to 2 cu. yds. and larger. Reeving up to 7:1 for heavy digging. Streamlined bowl contour for pay-load digging. Heavy jaws and strong, electric steel blade arms. Big sheaves and special counter weight design to keep sheaves up and out of muck. No fouling. Heavy corner arms, and offset hinge pins for maximum leverage. "Buckets that have what it takes."



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HAISS PNEUMATIC-TIRED LOADERS — 3 and 5 yds. capacity. Some general design as creeper machines but on heavy duty pneumatics. Traveling speeds up to 6 miles per hour. Same digging efficiency, same enclosed transmission, same balanced elevator, same easy control as all Haiss machines. Avalanche protection if desired. Lights also for night operation. Ideal in a paved yard or where ground is hard and firm.

HAISS TROUGHING BELT CONVEYORS. Heavy duty design. Close-spaced belt rollers on ball bearings. Tail pulley on Hyatt roller bearings. Alemite lubrication throughout. 4 ply heavy duty belt with rubber cleats. Rigid, strong truss frame. Gear winch adjustment for discharge height. Tubular steel chassis with roller-bearing, all-steel wheels. Enclosed tail end keeps tail pulley clean. Any length to 60 ft.; 16, 20 and 24 in. belts.

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- ☐ Hi-Power Digging Buckets
- ☐ Rehandling Buckets
- ☐ Model 135 Heavy Duty Loader—5 to 8 yds. per min.
- ☐ Model 80 Heavy Duty Loader—3 to 5 yds. per min.
- ☐ Model 75 Stockpile Loader—3 yds. per min.
- ☐ NEW 1941 Pneumatic Tired Loaders—3 to 5 yds. per min
- ☐ Haiss "Excavator"—for shallow grading.
- ☐ Haiss Troughing Belt Conveyors
- ☐ Hopper Gates
- ☐ Revolving Screens
- ☐ Elevator and Conveyor Systems and Parts

Name of Individual.....

Name of Company.....

Street and Number.....

City and State.....

Equipment Rental Rates

EARLIER THIS YEAR the Associated Equipment Distributors published a "Compilation of Rental Rates for Construction Equipment" from which we quote the following paragraphs of the Foreword:

"The following compilation of rental rates for construction machinery is the result of several years' endeavor to effect a rental schedule applicable to all sections of the United States. It has long been recognized in the industry that if this effort could be brought to a successful conclusion, it would be a great benefit to all distributors of construction machinery from coast to coast.

"Because of many prevailing local conditions, rental rates are not exactly the same in any two sections of the country. The greatest effort, therefore, was to harmonize, as nearly as possible, these different rates. Therefore, the following schedule of rental rates represents what may be called an average of the rental rates throughout the United States. As such, it can be considered merely as a guide to all those engaged in the construction industry, and not an effort to fix rental rates in any section of the country.

". . . it is believed the publication of this compilation will be of immeasurable benefit to contractors and all others engaged in the construction industry, especially during this time of national emergency."

This Rental Rate is available at $1.00 per copy from the compilers—Mr. Eldon M. Farnum, Chairman of the Rental Committee, Associated Equipment Distributors, c/o Geo. F. Smith Co., Franklin and Channing Ave., St. Louis, Mo.

Engineering News-Record is pleased to be able to print representative rates from this schedule as the first column of its "Equipment Rental Rate" table. Also presented, in accord with an *ENR* practice of the past several years, are the rental rates for various sections of the U.S. which were supplied by equipment distributors throughout the country.

All prices are for equipment in good operating condition for one shift. A.E.D. recommends a 50 percent increase for two shift and 100 percent increase in rates for three shift operation.

Monthly Rental in Seven Areas

Description	Assoc. Equipment Distributors	New England	New York	Philadelphia Area	North Central States	St. Louis Area	New Orleans
Aggregate Handling							
Batchers for weighing two materials	80	.....	.....	.....	80	75	80
Batchers for weighing three materials	100	.....	.....	200	100	90	100
Two compartment bins 50 ton	.....	.....	.....	300	110	140	.....
Two compartment bins 100 ton	.....	.....	.....	.....	150	175	.....
Boilers							
Vertical 20 to 30 hp	75	75	.....	75	75	40	75
Vertical 60 to 75 hp	125	.....	.....	100	100	100	150
Horizontal 50 to 60 hp	105	.....	.....	125	100	100	.....
Horizontal 80 to 100 hp	150	175	.....	150	200	150	.....
Buckets							
Concrete single-line bottom dump, 1 yd	30	.....	65	35	35	15	30
Concrete single-line bottom dump, 2 yd	50	.....	.....	50	50	35	50
Concrete tipover type 1 yd	20	.....	25	20	20	10	.....
Clamshell ¾ yd	95	70	130	100	90	75	100
Clamshell 1½ yd	140	90	.....	160	150	90	150
Dragline 1 yd	85	90	.....	115	115	75	90
Dragline 1½ yd	110	90	.....	150	150	100	130
Orange peel 1 yd	150	.....	.....	150	150	75	.....
Carts, concrete							
6 cu.ft. rubber-tired	12	.....	21	6	15	10	15
9 cu.ft. rubber-tired	15	.....	25	9	20	10	20
Compressors							
Portable, gasoline 105 ft	150	175	175	150	150	125	150
Portable, gasoline 210 ft	300	300	215	250	275	275	300
Portable, gasoline 315 ft	400	350	260	375	300	400	.....
Portable, diesel 210 ft	350	375	.....	325	300	350	350
Portable, diesel 315 ft	460	425	.....	450	600	450	.....
Cranes							
Gas crawler ⅜ yd	350	.....	.....	500	400	350	350
Gas crawler ¾ yd	500	450	.....	650	500	450	500
Gas crawler, 1 yd	600	550	1000	750	550	500	600
Gas crawler, 2 yd	1400	.....	1400	1350	1000	1000	.....
Diesel crawler ¾ yd	600	525	.....	600	550	550	.....
Diesel crawler 1 yd	700	625	.....	850	660	700	.....
Diesel crawler 2 yd	1700	.....	.....	1625	1500	1250	.....
Locomotive, steam 22–25 ton	700	.....	.....	.....	600	700	.....
Gas driven 10 ton truck crane, per hour	15	.....	.....	8	10	15	20
Drills, pneumatic							
Jackhammer or paving breaker	35	35	55	35	30	30	35
Wagon drills	175	150	170	125	150	150	.....
Generator sets, complete — a.c. or d.c.							
1 kw. gas engine driven	40	.....	.....	100	50	50	.....
5 kw. gas engine driven	90	.....	155	200	85	90	100
10 kw. gas engine driven	150	.....	.....	.....	125	125	.....
Hoists							
Electric double drum, 20 hp	90	.....	109	90	70	85	100
Electric double drum, 50 hp	156	.....	120	170	150	150	175
Gas, double drum, 20 hp	80	.....	65	90	95	75	75
Gas, double drum, 60 hp	175	.....	163	170	160	175	175
Chain, hand powered, 5 ton	30	.....	.....	.....	30	25	.....
Mixers							
Power loader, 7-S	85	100	145	90	85	75	90
Power loader, 14-S	155	125	175	160	135	150	175
Batch hopper, 28-S	210	.....	260	200	195	195	.....
Paver, 27-E new type	750	550	239	650	500	650	900
Unmounted truck mixer 2½ cy	300	.....	239	300	200	350	.....
Unmounted truck mixer 4 cy	400	.....	.....	450	300	450	.....
Pile hammers							
McKiernan-Terry #2	70	.....	110	90	60	50	75
Union #2, McK-T #7	135	.....	175	168	150	100	150
Vulcan #1	175	.....	.....	200	200	150	200
Union #1, McK-T #9B2	175	.....	.....	240	200	175	200
Vulcan Pile Extractor #400	140	.....	.....	125	150	100	.....
Pumps							
Triplex, 35–40 hp	125	.....	220	200	150	150	150
Gas centrifugal, 2 in	40	.....	65	50	40	35	.....
Gas centrifugal, 4 in	80	.....	110	100	75	50	80
Elec., centrifugal, 6 in	.....	130	150	115	150	.....	75
Hand diaphragm, 4 in	8	.....	.....	10	12	10	.....
Power, open top double diaphragm, 4 in	65	.....	65	60	50	45	75
Concrete, double cylinder	.....	.....	.....	.....	.....	475	.....
Road finishing machines							
15–20 ft. roadway width	350	.....	.....	300	275	400	400
24–30 ft. roadway width	375	400	.....	300	350	600	475
Road rollers							
Gas, 3 wheel, 8 ton	270	.....	.....	225	200	300	325
Gas, 3 wheel, 12 ton	425	225	.....	250	275	350	450
Gas, tandem, 5–8 ton	200	225	.....	225	175	250	350
Gas, tandem, 8–12 ton	250	.....	.....	250	225	300	.....
Scrapers							
Single bowl, 4 yd	225	.....	.....	.....	450	250	.....
Single bowl, 8 yd	325	.....	.....	.....	600	350	.....
Single bowl, 16 yd	650	.....	.....	.....	800	550	.....
Double bowl, 12 yd	525	.....	.....	.....	800	500	.....
Double bowl, 20 yd	800	.....	.....	.....	1100	600	.....
Shovels							
Gas crawler ⅜ yd	400	300	.....	550	350	350	.....
Gas crawler ¾ yd	550	450	.....	700	550	450	650
Gas crawler 1¼ yd	800	700	.....	850	700	700	950
Diesel crawler ¾ yd	650	525	.....	700	650	550	.....
Diesel crawler 1¼ yd	950	725	.....	1000	850	750	.....
Tractors, crawler							
30 hp. gasoline	225	.....	.....	225	200	200	.....
75 hp. gasoline	425	.....	.....	450	450	300	.....
50 hp. diesel	350	.....	.....	475	350	300	.....
75 hp. diesel	675	.....	.....	625	400	400	.....
100 hp. diesel	800	.....	.....	750	600	700	.....
Bulldozer for 75 hp	145	.....	.....	100	150	150	.....
Angledozer for 75 hp	175	.....	.....	125	200	150	.....
Welding machines							
200 amp. gasoline engine driven	85	.....	210	125	125	100	100
400 amp. gasoline engine driven	110	.....	.....	175	180	150	125
Vibrators							
1 hp. gas-engine driven, flexible shaft	40	.....	65	.....	50	45	50
3 hp. gas-engine driven, flexible shaft	60	.....	95	.....	75	70	75

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